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Boston University
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Dissertation

WHAT MEASURES DO CHILDREN KNOW, AND WHY

Submitted

by

Mabel Elizabeth Cassell

(A.M. Boston University, 1933)

(In Partial Fulfillment of Requirements for the

Degree of Doctor of Education)

1941

Committee on Acceptance

Dr. Guy M. Wilson - Chairman
Dr. Herbert F. Blair
Dr. Donald D. Durrell

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TO MY MOTHER

In acknowledgement of her constant encouragement, sacrifices, and help in making numerous tabulations for the study, this volume is lovingly dedicated

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CHAPTER I

THE PROBLEM

In recent years the theory of social utility has been strongly urged as a basis for determining useful material to be taught in arithmetic. The present study is definitely a curriculum study. It has been undertaken for the purpose of determining what is useful in the field of measures and denominate numbers. Problems which this study attempts to solve are here set forth.

1. What do grade pupils know or not know in the way of measures and denominate numbers?
2. Why do they know what they know?
3. Are the same measures known and used by pupils in all sections of the country?
4. Is the ability to apply measures prominent with these pupils?
5. Is there a difference in the measures used by those in the rural localities as compared to the cities?
6. Is maturity a vital factor in the measures and denominate numbers known and used by children?
7. Are sex differences in the use of measures and denominate numbers evident or significant?
8. Are tables of measures, as such, taught in these schools?

This study is directly in line with previous studies in the field which have been conducted for a similar purpose. These studies are here briefly reviewed according to the nature of the field investigated.

BUSINESS ENTERPRISES

Wilson[1] (1911) sent a questionnaire to the business men of the community of Connersville, Indiana for the purpose of ascertaining what type of arithmetic was used in business. They were asked to check, from among the items on the questionnaire, the ones for which they had considerable use over a period of six months and those for which they had little or no use for the same period of time. As for measures, the replies indicated that these business men were decidedly in favor of the elimination of Troy weight, apothecarie's weight and the surveyor's table. Their basis for suggesting the elimination is that they have no practical value to the majority of people.

Another study[2] was made by Wilson (1918) in which he attempted to find the actual arithmetic used by adults in their business and social life. For this prupose he devised and used the School-Pupil-Survey method which proved to be an efficient method of securing data from a wide area in a short period of time. Superintendents, teachers, and pupils of the sixth, seventh and eighth grades in towns and cities of the Middle West cooperated in securing the necessary data. The pupils were provided with a blank on which they made daily reports of the problems which were solved by their parents. In this way 14,583

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1. Wilson, Guy M., et al., A Course of Study in Elementary Mathematics for the Connersville Schools, Warwick and York, Baltimore, 1911.

2. Wilson, Guy M., A Survey of the Social and Business Usage of Arithmetic, Contributions to Education, No. 100, Teachers' College, New York, Columbia University, 1919.

problems were submitted by a reasonably representative group, distributed among 155 different occupations. The study revealed that

(a) square, time, liquid, cubic, dry, linear and circular measures, measuring, avoirdupois weight, carpeting, plastering, papering and mensuration represented but a very small percentage of the processes reported,

(b) apothecaries and Troy weight appeared so few times that it seemed advisable to suggest they be eliminated from the arithmetic of the elementary grades,

(c) reduction of denominate number, table of folding paper, surveyor's and foreign money tables, most of mensuration,- the trapezoid, trapezium, polygons, frustrum, and sphere did not appear in the study.

In 1919 Wise[1] made a more widely extended study by means of the School-Pupil-Survey method, including the states of Wisconsin, Illinois, Iowa, Missouri, Texas and California. He made use of superintendents, principals, teachers in high school, and grades six, seven and eight in gathering the data from adults as to the type of arithmetic they used in their daily activities. The findings of Wise are almost identical with those of the Wilson survey.[2] He found that problems in mensuration, cubic and square measure, were used occasionally in connection with farm work, such as finding the cubical contents of bins, silos, cribs, etc. There were no problems involving apothecarie's

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1. Wise, Carl T. "Arithmetic Problems Arising in Various Occupations", Elementary School Journal, 20: 118-136, October, 1919.

2. Wilson, op. cit.

or Troy weight, as only the common units of weights and measures are used by the average individual. His study also revealed that people were seldom called upon to use or solve problems relating to painting, plastering and masonry. He recommends that time in school be given to the common measures which are useful.

Mitchell[1] (1919) sought to determine the relative importance of various elements of arithmetic by examining the arithmetic appearing in a hardware catalogue, marked-down sales advertisements, a standard cook book and the payrolls of several flower and feather factories. The most commonly used measure in connection with the factory payrolls and the hardware catalogue was the dozen, it being the sole unit of measurement[2] used in the factory payrolls. Measures used frequently in the hardware catalogue were foot, inch, yard, pound, ounce, gross, quart, hundred, square foot, hundred-foot and hundred square feet. The dozen and gross appeared 1974 times out of a total of 407 units of measurement. Measures which appeared in the cook book are teaspoonful, tablespoonful, cup, pint, quart, gallon, peck, ounce, pound and unit. No reductions were apparent in the study.

Woody[3] (1922) examined 4,661 bills of sale from three large

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1. Mitchell, H. Edwin, "Some Social Demands on the Course of Study in Arithmetic," Seventeenth Yearbook of the National Society for the Study of Education, Part I, pp. 7-17, 1918.

2. Units of measurement refers to the separate units of the tables of measures.

3. Woody, Clifford, "Types of Arithmetic Needed in Certain Types of Salesmanship," Elementary School Journal, 22: 505- 520, March, 1922.

wholesale and retail stores in Seattle, Washington to secure information concerning the arithmetic needed by clerks in the selling of goods and by the consumers in the purchasing of goods. His study revealed the following conclusions:

(a) that reduction of denominate numbers and denominate numbers as such are not used in either the purchasing or selling of goods,

(b) that such measures as dozen, yard, pound, foot, inch, bale, pair and fractional portions or multiples of these units were used extensively,

(c) that the dozen was especially used in connection with the hardware business, strictly in terms of dozen and not in terms of lower units. Fractional parts of the gross were used such as 1/2 and 1/4 gross, but no reductions were attempted. The same is true with yard in connection with hardware and department stores. He indicates that evidence could be cited in the use of such measures as gallon, pound, inch, ton and barrel.

A study was made by Bowden[1] (1929) from the consumer's viewpoint. Two questionnaires, called answeraires, were used. Eighteen different types of arithmetic were included, among which are denominate numbers and measures. The first questionnaire, containing 345 problems

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1. Bowden, A. O., "Consumers Uses of Arithmetic," Contributions to Education, No. 340, Teachers' College, New York, Columbia University, 1929.

which he selected and assumed to be useful types, were checked by 682 persons chosen from nearly all walks of life in cities in New Mexico, Illinois and Kentucky. They were to check the actual use or remembered use of these eighteen different types according to the life situations of buying, making change, reading, investing, writing, travel and recreation. The second blank, consisting of selected items from the first questionnaire, was sent to superintendents of cities in six different states. These were given to sixth grade children who took them home to be filled out by their parents. There were 740 returns. Of the eighteen types investigated, he found compound denominate numbers to be among the most commonly used.[2] He assumed all the items investigated to be legitimate ones for school instruction. On the basis of this assumption he recommends the teaching of the most commonly used ones. He made no attempt to ascertain the specific type of denominate numbers which are useful.

Six leading business stores of Porto Rico were studied by Traniello[1] (1930) to secure data concerning the useful measures in business. Those checked were a department store, a drug store, a wholesale grocery house, a retail grocery store, a furniture manufacturing company and a tobacco company. Of a possible 89 units of measurement, only 50 were involved in making the study. Of this number only 29 units of measurement were actually being used in these different business concerns. Of a total of 415 items listed in the

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1. Traniello, Angelo, Tables of Measures in Business, Master's Thesis, School of Education, Boston University, 1930.

2. The soundness of Brueckner's conclusions had been questioned previously by other students.

study, only 7 items called for more than one unit of measure. These 7 units are distributed thus, the department store 3, the drug store 1 and the retail grocery store 4. It is interesting to note that a table of measure is never used in its entirity and that reduction of denominate numbers is absent. When two units are needed to indicate a commodity, it usually means a double description, e.g., 3 feet of $\frac{1}{2}$ inch tubing.

Louth[1] (1931) studied five of the leading industries in cities in the state of Rhode Island to determine what measures are used in industry. Her findings indicated that:

(a) of a possible 93 units of measurement, only 33 units were used in these five industries, with but 23 percent of those employed making use of them, thus indicating that three-fourths of the persons employed, or 77 percent did not need to use or understand any units of measurement.

(b) of the 18 different tables of weights and measures that were listed, units from only 12 were required in these five industries.

(c) a table of measurement as such is seldom used in its entirity, usually only one unit of the table being necessary.

(d) the inch is the most common unit of measurement with the pound (avoirdupois) ranking second in frequency.

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1. Louth, Mary DeSales, Measures in Industry, Master's Thesis, School of Education, Boston University, 1931.

From her study she concluded that there is no need for the memorization of the tables of weights and measures, that the addition, subtraction, multiplication and division of compound denominate numbers have little, if any, value, and that reductions ascending and descending have no value.

Another study in the field of industry was made by Sala[1] (1931). He checked on the measures used by iron, ball bearing and hardware factories in New Britain, Connecticut. His conclusions compare favorably with those of the Louth study. He found that:

(a) over 61 percent of the persons employed in the four factories did not need to use or understand any of the 18 units, of the 67 possible units of the 11 tables, used by the four factories. This means that 39 percent of the employees are experts who have been trained for their work.

(b) a table of measure is never used in its entirity.

(c) the inch and the pound were the most common measures used, with the pound rating second in frequency.

(d) the memorizing of tables and the teaching of addition, subtraction, multiplication and division of compound denominate numbers has little or no value in industry.

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1. Sala, Vincent, Measures in Industry, Master's Thesis, School of Education, Boston University, 1931.

Dalrymple's[1] study (1934) of the fractions used in business and life in connections with several prominent business firms in the city of Boston revealed some interesting data concerning measures as related to fractions. All told there were 20641 units of measurement found in the study. Those appearing most frequently are inch, size, number, wool, yard, foot pint, quart, ounce, pound, horse power, cent, and carat. They represent 97.785 percent of the total number of 20641 units of measurements. Inch was the most frequently used of all the measures. Yard was the next most frequently used measure in the study of household equipment, while size appeared most frequently with clothing. As a measure wool was used in refering to an article as 60 percent wool, etc. There is no indication of the reduction in denominate numbers. Where fractions were involved, commodities were sold or purchased on the basis of fractional parts previously determined.

During the summer of 1936 the writer made a preliminary study[2] of six woolen and worsted mills in the state of Massachusetts for the purpose of securing information concerning the measures used in the wool industry. It is interesting to note the marked similarity of the measures used in this industry as compared to the two previous studies. Aside from the pick measure, used in noting the number of times the shuttle crosses the loom in a week, the pound is the most frequently used measure. Such measures as ounce, gram, kilowatt, ton,

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1. Dalrymple, Charles O. Fractions in Business, Doctor's Dissertation, School of Education, Boston University, 1934.

2. Unpublished data.

and square foot are used by those employed in the clerical, purchasing, and dyeing departments. These individuals represent a very small group who are especially trained for their work. Other measures used are the inch, foot, yard and hour. Of the 4600 employees of the two mills, from which specific information was received, 3865 persons or 84.0 percent do not need to make use of any measures.

Several wool merchants[1] of the city of Boston were interviewed concerning the type of measures used in the purchasing of wool. Pound was found to be the only measure used. Wool may come by the bag, carload, bale, or ton but is measured in terms of pound, since the number of pounds to a bale, bag, or carload varies.

EDUCATIONAL FIELDS

Jessup and Coffman[2] (1914) sent a questionnaire to 1700 superintendents of cities of 4000 population or over and to every sixth county superintendent in the United States asking them to check items which in their opinion should be eliminated from the course of study in arithmetic. The returns from 867 cities and 114 county superintendents indicated a decided tendency in favor of either eliminating or spending less time on alligation, cube root, progression, and the obsolete tables of surveyor's measure and folding paper. The study indicates a decided emphasis on the more useful processes in arithmetic.

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1. Unpublished data.

2. Jessup, W.A., "Current Practices and Standards in Arithmetic," Fourteenth Yearbook of the National Society for the Study of Education, Part I, pp. 116-130, 1915.

A survey made by Chase[1] (1917) on mensuration consisted of a test on finding the areas and volumes of the square, rectangle, rhomboid, triangle, and circle, and the use made of mensuration in out-of-school life. Of the children (grade 7) who took the test on finding areas and volumes, 44 percent could not find any one of them. Only one of the fifteen teachers found all of them correctly. In seeking information concerning the use made of mensuration facts out of school, she found that 68 percent of the women and 30 percent of the men crossed out everything, thus indicating no use whatsoever for them. The manual training teachers indicated that, aside from board feet, areas and volumes were needed in their work. She questions much of the work found in the arithmetic textbooks.

Noon[2] (1919) sought to determine what arithmetic should be acquired by children by the time they reach the seventh grade. Children of a good residential section of Boston were asked to tell what use of numbers they made or noticed outside of school. Among the items listed only a very few related to measures. Ability to tell time and a knowledge of pound, as related to the quantity of articles to be purchased, were reported by children in the fourth grade. The only

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1. Chase, Sara, "Waste in Arithmetic," Teachers College Record, 18: 350- 370, September, 1917.

2. Noon, Philo G., "The Child's Use of Numbers," Journal of Educational Psychology, 10: 462- 467, October, 1919.

measure reported in the fifth grade was that of measuring objects. The sixth grade children did not report any, while the seventh (a low seventh grade) reported the use of scales in weighing and the timing of food in cooking.

By means of the personal interview method Smith[1] (1924) with the assistance of teachers gathered information from 500 advanced first-grade (1A) children in Detroit. Each of them was interviewed twenty times, giving a total of 10,000 interviews. Of the various simple arithmetical operations used by these children, measuring ranked sixth, with a frequency of 5.5 percent. The measures used were very simple, being related to sewing, manual training, height, objects, distance, and such measures as pint, quart, and pound in playing store. This study indicates that spatial measurement plays a very small part in the use of numbers of first-grade children.

Williams[2] (1921) examined a textbook in Chemistry to ascertain what preparatory mathematics is needed by a college freshman student. In the body of the text 73 different denominate numbers were used, of which degree had the greatest frequency. First, second, third, once, twice, double, and triple were used quite frequently. In connection with problem solving, the gross, liter, and degree were frequently

---

1. Smith, Nila B., "The Uses of Arithmetic in the Out-of-School Life of First-Grade Children," Elementary School Journal, 24: 621-626, April, 1924.

2. Williams, L.W., "The Mathematics Needed in Freshman Chemistry," School, Science and Mathematics, 21: 654 - 665, October, 1921.

used, gross appearing the most frequently.

Callaway[1] (1923) in a companion study to that of Williams, examined a freshman textbook on clothing for women. The two most important measures used in making clothing she found to be long measure and United States money. Contrary to what one might think, the inch was found to be the most commonly used, appearing 1122 times out of a total of 1723 uses of denominate numbers. The dollar sign appeared 454 times, while the yard had a frequency of 70. Reduction of yards to inches, inches to yards, and drawing a line of a given length were used in the solution of problems. It is evident that only very simple work in reductions is necessary for even the college student of clothing.

The next three surveys are different from other studies, previously mentioned, in that each is confined to a single school system.

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1. Callaway, T.T., Mathematics Needed in a Freshman Course in Clothing, Unpublished study reported in Curriculum Construction by Charters, Macmillan Company, 1923, pp. 241-243.

The Edward Everett study[1] was confined to a single school building. Pupils in the seventh and eighth grades gathered data of actual figuring done by their parents over a period of two weeks. Less than one percent of the figuring done involved measures and denominate numbers.

The Melrose survey[2] made by teachers revealed practically the same results as the Edward Everett study, except that fractions and decimals were slightly extended, due to the fact that teachers sought out and interviewed a larger proportion of people in highly specialized industries.

A more recent survey[3] made in the Boston area by a group of Boston University students confirmed the findings of the other surveys so completely that the group did not find it necessary to complete the study. The only use made of denominate numbers was in the way of simple measures - dollars, cents, yards, quarts, etc.

The most far reaching study to date in the field of measures and denominate numbers is that of Dorothy Wilson[4] (1936). She made

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1. Wilson, Guy M., What Arithmetic Shall We teach? Houghton Mifflin Company, 1926, p. 60
2. Wilson, Ibid. p. 63.
3. Wilson, Ibid. p. 64.
4. Wilson, Dorothy W., What Measures Do People Know, and Why, Master's Thesis, School of Education, Boston University, 1936.

use of the questionnaire method in checking with 2,817 individuals distributed in the following manner, 1097 pupils in grades three to six, 961 pupils in junior and senior high school, 310 adults in New England, 332 adults in the Middle West, 43 adults on the Pacific Coast and 77 adults in the Southern states. The questionnaire consisted of one page calling for information concerning the way in which certain commodities are sold, the ability to apply measurement and the knowledge of certain measures and denominate numbers. Her conclusions are:

(a) that both children and adults have a knowledge of the measures used in the buying and selling of commodities with which they have had experience,

(b) that neither children nor adults are able to estimate heights, lengths, and distances with any degree of accuracy,

(c) that tabled facts which do not come within the experience of the child are little known,

(d) that even adults do not know certain tabled facts which are generally taught,

(e) that experience seems to be the most important factor in connection with the knowledge of measures and denominate numbers.

The present study, a companion to the Wilson study[1] is confined to the use of denominate numbers and measures among school children.

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1. Wilson, op, cit.

It covers a much wider range of territory, extending into 43 of the 48 states and the District of Columbia. As a repeated study it is fully justified as indicated by Peter's study[1] in which he shows that the massing of experiments on one theme greatly increases both reliability and validity.

Details of the plan of this study appear in Chapter II.

1. Peters, Charles C., "An Example of Replication of an Experiment for Increased Reliability," Journal of Educational Research, 32: 3-10, September, 1938.

CHAPTER II

THE METHOD OF PROCEDURE

As a basis for this study the questionnaire method has been used. It is recognized that there is much of unreliability in the use of this method. However, for this particular study it seemed the best procedure to use in gathering information from a wide area. With the cooperation of her directing professor, the writer was personally enabled to try out the present form of the questionnaire with a representative group of students at Boston University before sending it out to schools throughout the country. Previous studies of a similar nature had given basis for criticism and modification of the questionnaire.

Form of Questionnaire

The form of the questionnaire, as shown in Exhibit I, is similar to the one used and recommended by Dorothy Wilson[1] in her study on denominate numbers and measures. In drafting the questionnaire slight modifications were made. A few different and additional items were included with a total slightly in excess of the number in her questionnaire. The last section is entirely new. It seemed advisable to limit the number of selected choices for each answer to three, indicated by "1", (school), "2", (experience), and "3", (guess) in the questionnaire.

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1. Wilson, D., op. cit. p. 21.

MEASURES AND DENOMINATE NUMBERS

Name _____ Boy _____ Girl _____ Age _____
Name of school _____ Grade _____
Father's occupation _____ Mother's occupation _____
Lines of work you have done at home or for pay _____
Number of years spent in public schools _____

In answering the following questions, indicate after each answer a number as follows: (1) learned in school (2) learned it from experience (3) guessed. Place ONLY ONE number after each question.

I Indicate how each article is sold. The answer to the first one is given.

		(Answer)	(Number 1, 2, or 3)
Sample:	butter	pound	(2)
1.	farm land		
2.	potatoes		
3.	Cotton lint		
4.	eggs		
5.	coal		
6.	nails		
7.	wood		

II Answer these questions, followed by the number 1, 2, or 3. The first one is answered.

		(Answer)	(Number 1, 2, or 3)
Sample:	How many feet in a yard?	3	(1)
1.	How many inches in a foot?		
2.	How many seconds in a minute?		
3.	How many cups of milk in a pint?		
4.	How many cubic inches in a cubic foot?		
5.	How many acres in a quarter section?		
6.	How many pounds in a bushel of wheat?		
7.	How many penny-weight in an ounce?		
8.	How many dozen eggs in a crate?		
9.	How many rods in a mile?		
10.	How many pecks in a bushel?		
11.	What is a good average yield of cotton per acre?		
12.	What is a good average yield of wheat per acre?		

III Give the required dimensions and follow each by the number 1, 2 or 3.

		(Answer)	(Number 1, 2 or 3)
1.	Height of dining-room table		
2.	Height of ceiling of living-room		
3.	Distance between rails of railroad		
4.	Glove size of average man		
5.	Width of regular full size bed		

IV Answer the following question by underlining either the word YES or NO.

1. Are you taught the tables of measures as tables? YES NO

The questionnaire consists of four sections, each calling for a different type of information concerning measures. Section I calls for information with respect to the way in which seven different commodities are sold. The commodities chosen are common in trade, some in all parts of the country and some in selected parts of the country. They presumably will be known to those who have had experience in making purchases.

Section II includes two types of material, that studied in school and that which was not. For instance II-4, the number of cubic inches in a cubic foot, was presumably studied in school while such items as II-8, the number of dozen eggs in a crate, and II-12, the average yield of wheat per acre, were not, except as wheat yields entered into written problems. The answers to the latter would, of necessity, be based upon experience. An item such as II-3, the number of cups of milk in a pint, might possibly fall under either group.

The items in Section III call mainly for the ability of the individual to estimate distances. The ones included are those which, in general, are familiar. The aim is to check on whether or not concepts have been built up in such form as to be practically usable. With a previous established concept of yard, foot, and inch, one should be able to estimate distances with a fair degree of accuracy.

The purpose of Section IV is to ascertain if the tables of measures are still taught in the schools.

Directions

The questionnaires were accompanied by two sets of directions one for the teacher and one for the pupils. A copy of each follows.

To the teacher: No doubt you have heard about the questionnaire which I wish to be filled out, as arrangements have been made with your superintendent. Please have children in grades 3 to 9 participate. Be sure they fill in all the blanks at the top of the page. Do not assist them in filling in the other blanks except to encourage them to do all or as many as they can. Enclosed you will find a stamped envelope for the return of the blanks. I wish to thank you for your assistance and prompt reply.

To the pupil: Please fill in the blanks to the best of your ability. You are not to be graded on the work but are doing it as an accommodation to me. Do your own work. Be sure to fill in the blanks at the top of the page. Where it asks for the name of your school, please indicate the name of the state also. Do your very best. Thank you for helping me by filling in these blanks.

To Whom Questionnaire was Sent

Pupils in grades three to nine on the elementary and junior high school levels of the Seventh-Day Adventist schools were selected

for this study.[1] Returns came in from second and tenth grade levels and so these have been included. The schools are located in practically every state in the United States. In general, the teaching of arithmetic in these schools does not differ from that taught in the public schools. Couch's study,[2] based on the Illinois standardized test, showed no statistical significant difference in the achievement in arithmetic between public school children and Seventh-Day Adventist school children. These children were selected as the writer was in a position to secure the desired information with a fair degree of success as the returns indicate. An attempt has been made to gather the information from both city and rural districts with the purpose of ascertaining whether there is any significant difference or not.

Questionnaire Returns

Of the 9671 questionnaires sent out, 6996 returns were received. This represents a percentage of 72.3. Of the 6996 an aggregate of 423 were either returned blank tests not needed or ones not usable because of insufficient data as to sex, grade, school, etc. The percentage of returns, not including these, is 67.9, or a total of 6573 usable in this study.

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1. Through the courtesy of a relative who is superintendent of a consolidated public school in a rural section of the state of Ohio, 295 questionnaires were administered in his school in order to increase the number of returns from rural sections.

2. Couch, Mary Irene, Achievement in Arithmetic of Children in Seventh-Day Adventist Parochial Schools, Master's Thesis, Nebraska University, 1931.

The number sent out and the usable replies are as follows for the 43 states and the District of Columbia.

	Sent out	Usable returns
Alabama	88	50
Arizona	96	63
Arkansas	158	77
California	2400	1372
Colorado	371	350
Connecticut	49	33
District of Columbia	438	132
Florida	320	213
Georgia	61	49
Idaho	94	73
Illinois	215	200
Indiana	200	140
Iowa	178	87
Kansas	90	44
Kentucky	53	30
Louisiana	92	48
Maine	36	23
Maryland	15	12
Massachusetts	209	180
Michigan	600	587
Minnesota	186	114

	Sent Out	Usable returns
Mississippi	8	6
Missouri	154	98
Montana	52	43
Nebraska	134	101
New Hampshire	14	10
New Mexico	90	62
New York	200	141
North Carolina	133	65
North Dakota	16	11
Ohio	353	353
Oklahoma	245	150
Oregon	500	377
Pennsylvania	212	189
Rhode Island	30	18
South Carolina	26	4
South Dakota	58	31
Tennessee	205	150
Texas	387	251
Virginia	234	121
Washington	396	280
West Virginia	46	33
Wisconsin	200	177
Wyoming	29	25
Total	6996	6573

The following list shows the distribution of the usable returns among the boys and girls in both city and rural sections.

	City			Rural		
	Boys	Girls	Total	Boys	Girls	Total
Alabama	3	23	26	14	10	24
Arizona	23	40	63	-	-	-
Arkansas	7	11	18	31	28	59
California	399	431	830	268	274	542
Colorado	113	140	253	57	40	97
Connecticut	15	18	33	-	-	-
District of Columbia	64	68	132	-	-	-
Florida	91	102	193	9	11	20
Georgia	22	23	45	2	2	2
Idaho	34	39	73	-	-	-
Illinois	60	61	121	40	39	79
Indiana	65	58	123	11	6	17
Iowa	27	36	63	7	17	24
Kansas	17	14	31	7	6	13
Kentucky	16	11	27	1	2	3
Louisiana	22	26	48	-	-	-
Maine	8	8	16	1	6	7
Maryland	4	8	12	-	-	-
Massachusetts	48	71	119	32	29	61
Michigan	217	231	448	74	65	139
Minnesota	36	46	82	17	15	32

	City			Rural		
	Boys	Girls	Total	Boys	Girls	Total
Mississippi	4	2	6	-	-	-
Missouri	20	28	48	31	19	50
Montana	11	23	34	5	4	9
Nebraska	18	15	33	44	24	68
New Hampshire	-	-	-	6	4	10
New Mexico	10	18	28	22	12	34
New York	59	62	121	12	8	20
North Carolina	19	35	54	4	7	11
North Dakota	-	-	-	2	9	11
Ohio	23	35	58	159	136	295
Oklahoma	46	59	105	23	22	45
Oregon	117	130	247	69	61	130
Pennsylvania	82	87	169	9	11	20
Rhode Island	7	11	18	-	-	-
South Carolina	2	2	2	-	-	-
South Dakota	15	10	25	3	3	6
Tennessee	45	41	86	28	36	64
Texas	53	79	132	65	54	119
Virginia	20	24	44	40	37	77
Washington	82	92	174	52	54	106
West Virginia	19	14	33	-	-	-
Wisconsin	21	38	59	54	64	118
Wyoming	5	7	12	6	7	13
Total	1969	2277	4246	1205	1122	2327

The number of cities and towns[1] from which returns were received totals 380. Of this number 255 are city and 125 are rural. It is regretted that information is not available for the other five states, namely Utah, Nevada, Delaware, New Jersey and Vermont. These states, it is noted, are from two widely separated sections of the country; however, it is felt that they are adequately represented by the returns received.

Validation of the Questionnaire

See Appendix E p. 189

Chapter III shows the plan used for the treatment of the data received.

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1. The names of the cities and towns of the 43 states and District of Columbia, with the number of useable returns for each, are to be found in Appendix A p. 157 The World Almanac and Book of Facts published by the New York World-Telegram (1939) was used as a basis for determining the cities and towns, the population of the latter being less than 2500.

CHAPTER III

PLAN OF TREATMENT OF DATA

Before interpretations of the data could be made the 6573 tests had to be treated statistically. This involved a number of steps. The vast amount of data prohibits the inclusion of all of it here and so portions of each step are shown in the accompanying exhibits. In the main, the state of Texas is used for this purpose.

Step I The responses for each child on the original test, as shown in Exhibit 1 (page 18) were brought together in more condensed form as shown in Exhibit 2. Everything was kept separate for each city, town, and state. Each child's paper in each grade was given a number as shown in column 1. Under the column headed sex, "B" stands for boy and "G" for girl. The grade was recorded in column 3. The remaining seven columns contain the responses for each child on each item of Section I. The exhibit is read thus. Number 1, a boy in the town of Keene, grade four, gave acre (A) as an answer with a "1" beside it, which means he learned it in school. A blank (-) means there was no response, while a response with no number after it, as number 8 for farmland in Elgin, means the child failed to record a number 1, 2 or 3 beside it. From this sheet it was possible to trace back to the original questionnaires any desired information. It was also easy to ascertain the number of any one response.

Later tabulations could have been made more easily had each city or town and the boys and girls in each been kept together. For

EXHIBIT 2 A portion of Section I for Texas showing the responses for each child for the Fourth Grade.

Section I. - cont.

TEXAS
(251)

	No.	Sex	Grade	Farm-1-land	2-Potatoes	Cotton 3-lint	4-Eggs	5-Coal	6-Nails	7-Wood
	1	B	4	A (1)	bu. (1)	----	doz.(2)	ton (2)	lb. (2)	----
	2	B	4	A (2)	lb. (1)	lb. (1)	doz.(2)	ton (1)	lb. (3)	rack (2)
	3	G	4	A (2)	lb. (2)	ton (3)	doz.(2)	ton (2)	lb. (2)	ton (2)
Keene	4	B	4	A (2)	peck (1)	lb. (2)	doz.(2)	ton (2)	lb. (2)	reak (2)
	5	B	4	A (1)	lb. (3)	----	doz.(1)	ton (1)	----	rick (2)
	6	G	4	A (2)	lb. (2)	lb. (3)	doz.	lb. (2)	----	lb. (3)
	7	B	4	A (2)	bu. (2)	yard (2)	doz.(2)	ton (2)	lb. (3)	rook (2)
	8	G	4	A (2)	lb. (1)	----	doz.(2)	----	lb. (3)	cart (3)
	9	G	4	A (2)	bu. (2)	----	doz.(2)	lb. (2)	lb. (2)	----
	10	B	4	A	lb. (1)	bale(2)	doz.(2)	----	lb.	cord (2)
Elgin	11	B	4	A (2)	lb. (2)	bale(2)	doz.(2)	load(3)	----	cord (2)
	12	B	4	A (2)	bu. (2)	bale(2)	doz.(2)	load(1)	lb. (2)	cord (2)
	13	G	4	A (2)	lb. (2)	bale(2)	doz.(2)	sack(2)	lb. (2)	cord (2)
	14	B	4	A (2)	lb. (2)	bale(2)	doz.(2)	----	lb. (2)	cord (2)
Corpus Christi	15	G	4	A (3)	lb. (3)	lb. (3)	doz.(2)	lb. (3)	lb. (3)	cord (2)
	16	G	4	lot (2)	lb. (2)	bale(2)	doz.(2)	ton (2)	oz. (3)	ton (2)
Amarillo	17	B	4	A (1)	bu. (1)	bale(2)	doz.(2)	ton (1)	pk. (3)	ton (3)
	18	G	4	A (2)	lb. (2)	----	doz.(2)	lb. (3)	----	----
Douglass	19	G	4	A (2)	bu. (2)	bu. (3)	doz.(2)	ton (3)	lb. (2)	rick (2)
	20	G	4	----	lb. (2)	----	doz.(1)	----	----	----
El Paso	21	G	4	----	----	----	----	----	----	----
	22	B	4	A (1)	bu. (1)	bale(2)	lb. (2)	lb. (2)	lb. (2)	cord (1)
Houston	23	G	4	A (1)	lb. (1)	lb. (1)	doz.(1)	----	lb. (1)	----
	24	B	4	A (1)	bu.	----	doz.	----	bag	cord
	25	G	4	A (1)	bu. (1)	bale(1)	doz.(1)	ton (1)	lb. (1)	cord (1)
Beulah	26	G	4	A (1)	bu.	bale	doz.	ton	lb.	cord
	27	G	4	----	bu.	bale	doz.	ton	lb.	cord
	28	G	4	A (2)	lb. (2)	yard(3)	doz.(2)	ton (1)	lb. (3)	load (3)
Pampa	29	G	4	A (1)	lb. (2)	----	doz.(3)	ton (1)	sack(3)	load (3)
	30	G	4	A (2)	lb. (2)	----	doz.(2)	ton (2)	lb. (3)	load (2)
	31	G	4	A (2)	cwt.(3)	ton (3)	doz.(2)	ton (2)	lb. (3)	ton (3)
	32	B	4	A (2)	bu. (2)	bale(2)	doz.(2)	ton (2)	lb. (2)	yard (2)
Fort Worth	33	G	4	lb.(1)	lb. (1)	lb. (3)	doz.(2)	lb. (3)	nail(3)	stick (2)
	34	B	4	lb.(3)	lb. (1)	sack(3)	doz.(1)	ton (2)	lb. (3)	lb. (3)
Douglass	35	B	4	----	bu. (2)	bale(2)	doz.(2)	----	----	----

instance, in Keene the five boys should come first followed by the two girls. Since this was not done it was decided to indicate the girls with a red pencil mark, as shown in Exhibit 2 (page) so they could be readily distinguished from the boys. It was decided to keep each city and each town separate after these tabulations were made and so the names of the cities and towns had to be written to the left of the numbers.

Sections II, III and IV of the questionnaire were treated in exactly the same manner as indicated above for Section I.

Step II The purpose of this step was to bring the data together in such a way as to secure the total number of different responses on any one item for boys and girls, city or rural, in any one given grade or grades. With the data in this form it was easy to make further combinations. Exhibit 3 (page 30) shows a portion of Section I for the state of Texas. Each section for each state was treated in the same way. The cities and towns were arranged in alphabetical order. It would have facilitated the work to have kept all the cities together and all the towns together. Since this was not done, an "R" was used to indicate the rural as shown in Exhibit 3.

Column 1 shows the grade (Gr), while column 2 contains the responses (Res). The next columns for each, the boys and girls, show how the responses were recorded. For instance, in Amarillo (city) in the third grade there is one girl but she gave no answer. This is shown by the number 1 under "B" (blank) in column 8. One boy answered acre (A) in grade four. This is indicated by the number 1 under "1"

EXHIBIT III A Portion of Section I for Texas Showing the Type and Number of Responses for Boys and Girls in Each Grade, City and Rural, on the Basis of "Blank", "N", (No Number), "1", (School), "2", (Experience) and "3", (Guess)

Texas — Section I

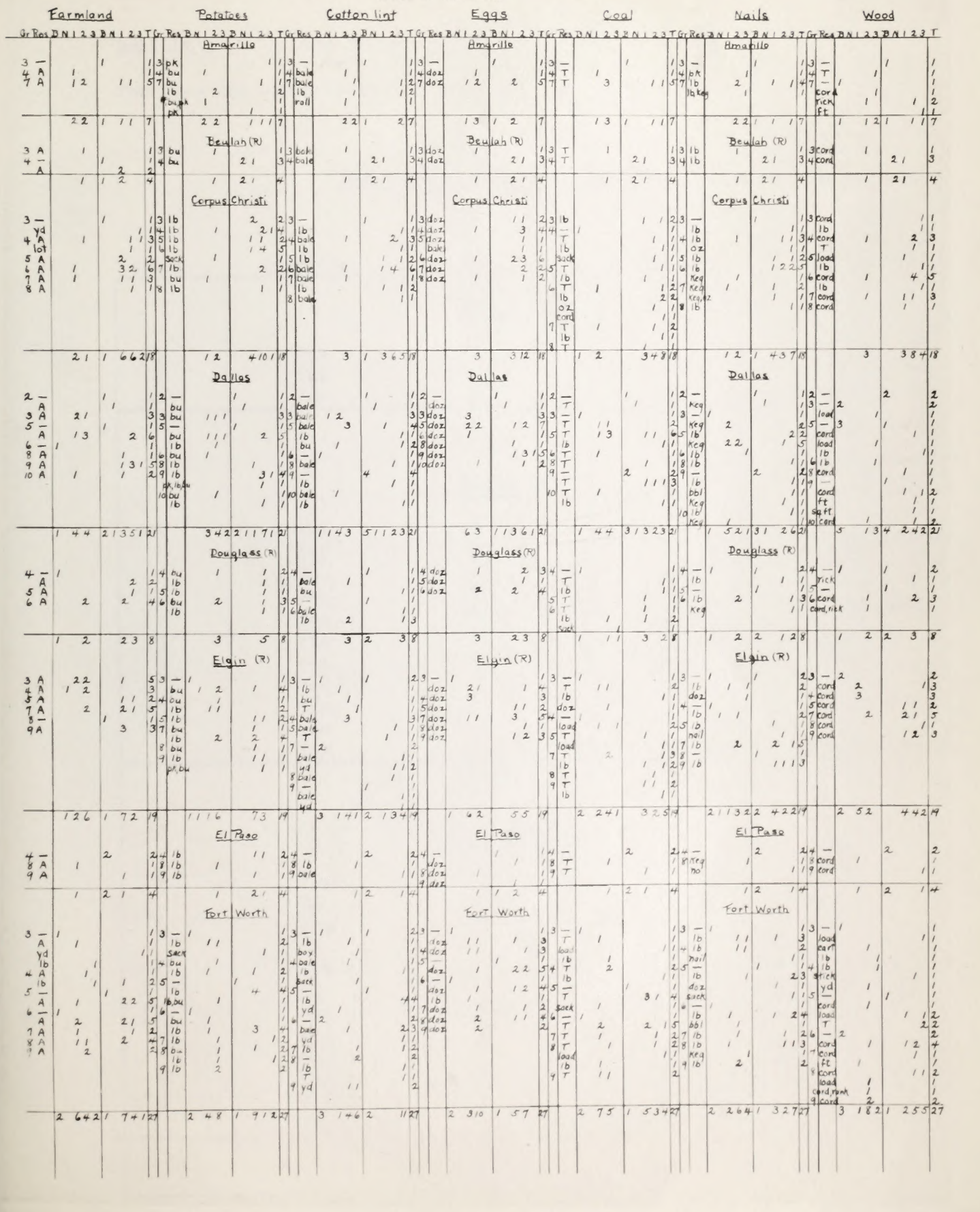

Exhibit 4 A Portion of Section IV for Texas Showing the Responses for Boys and Girls in Each Grade, both City and Rural

Tables of Measures - Section IV

Grade	Response	Boys	Girls	Total
		Douglass (R)		
4	Yes	1	2	3
5	Yes		1	1
6	Yes	2	2	4
		3	5	8
		Elgin (R)		
3	---	1		1
	Yes	3		3
	No		1	1
4	---	2		2
	Yes	1		1
5	Yes		2	2
7	---	1		1
	Yes	1	3	4
8	Yes		1	1
9	---		2	2
	Yes		1	1
		9	10	19
		Fort Worth		
3	Yes	2	1	3
	No	1		1
4	Yes	2		2
	No		1	1
5	Yes	1	4	5
	No		1	1
6	Yes	3	3	6
7	Yes	1		1
	No		1	1
8	Yes	2	2	4
9	Yes	1		1
	No	1		1
		14	13	27

in column 5. In grade seven one boy placed the number "1" beside the answer acre (A) while two boys placed the number "2" after their answers. These are indicated by the number 1 under "1" in column 5 and the number 2 under "2" in column 6. The responses for the girls in the seventh grade are recorded in the same manner. In case of a guess, the number "3" appeared beside the response. It was recorded under "3" as in column 12 for the girl in the third grade for Corpus Christi. The "N" as shown at the top of column 4 means that a correct response was given but no number appeared beside it. This is shown in Section I-4 for eggs under grade five where one boy answered pound but gave no number beside it. The number 1 is placed in column 4 marked "N". The last column headed "T" shows the total for boys and girls for each grade and the grand total, as 7 for Amarillo, for each city or town. Each column is also totaled and the number placed at the bottom. Sections II and III of the questionnaire were treated in exactly the same manner as Section I. Section IV was treated in a similar way as shown in Exhibit 4 (page 31).

Step III Beginning with this step only the correct responses are considered. Exhibit 5 (page 33) shows how the number of responses were brought together for each state keeping boys and girls and city and rural separate. Alphabetical arrangement was followed. Each item of the questionnaire for Sections I, II, and III was placed in the left hand column. The name of the state was placed at the top. Under each state there are two sections, one for city and one for rural.

Exhibit 5 Showing the Total Number of Correct Responses for Boys and girls, City and Rural, on Each Item of Sections I, II, and III for the State of Texas.

Texas (251)

	City			Rural		
	Boys (53)	Girls (79)	Total (132)	Boys (65)	Girls (54)	Total (119)
I- 1 Farmland	48	67	115	62	49	111
I- 2 Potatoes	50	75	125	62	54	116
I- 3 Cotton lint	8	25	33	26	11	37
I- 4 Eggs	51	74	125	64	54	118
I- 5 Coal	44	62	106	54	48	102
I- 6 Nails	43	56	99	54	41	95
I- 7 Wood	36	53	89	44	43	87
II- 1 Inches in a foot	48	73	121	63	53	116
II- 2 Seconds in a minute	45	67	112	62	52	114
II- 3 Cups of milk in a pint	35	50	85	45	35	80
II- 4 Cubic inches in a cubic foot	11	13	24	11	5	16
II- 5 Acres in a quarter section	8	4	12	7	1	8
II- 6 Pounds in a bushel of wheat	13	13	26	10	8	18
II- 7 Pennyweight in an ounce	2	3	5	2	1	3
II- 8 Dozen eggs in a crate	3	1	4	6	2	8
II- 9 Rods in a mile	11	9	20	13	12	25
II-10 Pecks in a bushel	32	43	75	43	32	75
II-11 Good average yield of cotton per acre	12	11	23	16	8	24
II-12 Good average yield of wheat per acre	9	8	17	7	7	14
III- 1 Height of dining-room table	2	4	6	5	4	9
III- 2 Height of living-room ceiling	23	21	44	11	3	14
III- 3 Width between rails of railroad	12	7	19	8	8	16
III- 4 Glove size of average man	13	32	45	16	9	25
III- 5 Width of full size bed	6	1	7	3	3	6

Exhibit 6 Showing the Percentage of Correct Responses for Boys and Girls, City and Rural, on Sections I, II, and III for Texas.

TEXAS

Section	City - 132 (53) Boys	(79) Girls	(132) Total	Rural - 119 (65) Boys	(54) Girls	(119) Total
I- 1 Farmland	90.6	84.8	87.1	95.4	90.7	93.3
I- 2 Potatoes	94.3	94.9	94.7	95.4	100.0	97.5
I- 3 Cotton lint	15.1	31.7	25.0	40.0	20.4	31.1
I- 4 Eggs	96.2	93.7	94.7	98.5	100.0	99.2
I- 5 Coal	83.0	78.5	80.3	83.1	88.9	85.7
I- 6 Nails	81.1	70.9	75.0	83.1	75.9	79.8
I- 7 Wood	67.9	67.1	67.4	67.7	79.6	73.1
II- 1 Inches in a foot	90.6	92.4	91.6	96.9	98.2	97.5
II- 2 Seconds in a minute	84.9	84.8	84.9	95.4	96.3	95.8
II- 3 Cups of milk in a pint	66.0	63.3	64.4	69.2	64.8	67.2
II- 4 Cubic inches in a cubic foot	20.8	16.5	18.2	16.9	9.3	13.5
II- 5 Acres in a quarter section	15.1	5.1	9.1	10.8	1.9	6.7
II- 6 Pounds in a bushel of wheat	24.5	16.5	19.7	15.6	14.8	15.1
II- 7 Pennyweight in an ounce	3.8	3.8	3.8	3.0	1.9	2.5
II- 8 Dozen eggs in a crate	5.7	1.3	2.9	9.2	3.7	6.7
II- 9 Rods in a mile	20.8	11.4	15.2	20.0	22.2	21.0
II-10 Pecks in a bushel	60.4	54.4	56.8	66.2	59.3	63.0
II-11 Good average yield of cotton per acre	22.6	13.9	17.4	24.6	14.8	20.1
II-12 Good average yield of wheat per acre	16.9	10.1	12.9	10.8	12.9	11.8
III- 1 Height of dining-room table	3.8	5.1	4.6	7.7	7.4	7.6
III- 2 Height of living-room ceiling	43.4	26.6	33.3	35.4	31.5	33.6
III- 3 Width between rails of railroad	22.6	8.9	14.4	12.3	14.8	13.5
III- 4 Glove size of average man	24.5	40.5	34.1	24.6	16.7	21.0
III- 5 Width of full size bed	11.3	1.3	5.3	4.6	5.6	5.0

The numbers below Boys, Girls, and Total represent the total number of individual responses. For instance, in the state of Texas there are 53 boys and 79 girls with a total of 132 responses for the city. For the rural there are 65 boys and 54 girls with a total of 119. Adding 132 for the city and 119 for the rural there is a total of 251 for the state. All other figures represent the number of correct answers on the various items.

With the raw scores there was no common basis for interpretations, so these were turned into percents as shown in Exhibit 6 (page 34). For instance for the city in Texas Section I-1, farmland, 48 boys (Exhibit 5) gave a correct answer. This is 90.6 percent of the total 53 boys. 67 girls (Exhibit 5) responded correctly. This is 84.8 percent of the total of 79 girls. Each item, city and rural, was treated in the same manner. Similar treatment was given Section IV and turned into percents as shown in Table XVI of Chapter IX.

Step IV The five representative states of Massachusetts, Minnesota, Ohio, Texas and Washington, with a total of 1178 questionnaires from fifty cities and towns, were selected for the purpose of noting the proportion of responses carrying "N",(No number), "1", (School), "2", (Experience) and "3", (Guess). Exhibit 7 (Page 36) shows how the cities and towns for each state were treated separately. This exhibit is read in the same manner as Exhibit 3 (p.30).

A summary was made of all the responses, city and rural, for each of the five states. Exhibit 8 (page 37) shows these for the State of Texas. These were then turned into percentages as shown in Chapter VI and Appendix C (p.179).

EXHIBIT 7 Showing a Portion of the Distribution of the Correct Responses for Boys and Girls, City and Rural, on the Basis of "N" (No number), "1" (School), "2" (Experience), and "3" (Guess) for Texas.

TEXAS

	City Weslaco (18)										Rural Beaulah (4)										Rural Douglass (8)									
	Boys-6					Girls-12					Boys-1					Girls-3					Boys-3					Girls-5				
	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T
I- 1 Farmland	0	0	6	0	6	0	0	12	0	12	0	0	1	0	1	0	2	0	0	2	0	0	2	0	2	0	2	3	0	5
I- 2 Potatoes	0	0	6	0	6	0	0	12	0	12	0	0	1	0	0	2	1	0	0	3	0	0	3	0	3	0	2	3	0	5
I- 3 Cotton lint	0	0	0	1	1	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	1	1
I- 4 Eggs	0	0	6	0	6	0	1	11	0	12	0	0	1	0	1	0	2	1	0	3	0	0	3	0	3	0	2	3	0	5
I- 5 Coal	0	2	3	1	6	0	0	6	5	11	0	0	1	0	1	2	1	0	0	3	0	0	0	1	1	0	3	0	2	5
I- 6 Nails	0	0	4	2	6	0	0	6	4	10	0	0	1	0	1	2	1	0	0	3	0	0	2	0	2	0	0	1	2	3
I- 7 Wood	0	1	5	0	6	1	1	4	0	6	0	0	1	0	1	2	1	0	0	3	0	0	2	0	2	0	0	3	0	3
II- 1 Inches in a foot	0	3	3	0	6	0	12	0	0	12	0	0	0	1	1	1	2	0	0	3	0	3	0	0	3	0	4	0	0	4
II- 2 Seconds in a minute	0	2	4	0	6	0	10	2	0	12	0	0	0	1	1	1	2	0	0	3	0	1	2	0	3	0	3	2	0	5
II- 3 Cups of milk in a pint	0	2	3	0	5	0	4	5	1	10	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	3	1	0	4
II- 4 Cubic Inches in a cubic foot	0	1	0	0	0	0	2	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
II- 5 Acres in $\frac{1}{4}$ Section	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
II- 6 Pounds in a bushel of wheat	0	1	1	2	4	2	1	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
II- 7 Pennyweight in an ounce	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
II- 8 Dozen eggs in a crate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
II- 9 Rods in a mile	0	0	2	1	3	1	1	0	0	2	0	0	0	1	1	2	0	0	0	2	0	2	0	0	2	0	1	0	1	2
II-10 Pecks in a bushel	0	2	2	0	4	0	5	1	0	6	0	0	0	1	1	0	1	0	0	1	0	1	1	0	2	0	2	0	1	3
II-11 Wheat yield per acre	0	0	0	4	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0
II-12 Cotton yield per acre	0	0	0	1	1	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
III- 1 Height of dining-room table	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
III- 2 Height of living-room ceiling	0	0	2	2	4	0	0	1	5	6	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0	0	1	1
III- 3 Width between rails of railroad	0	0	2	1	3	0	0	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
III- 4 Glove size of average man	0	0	1	2	3	0	0	0	5	5	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1
III- 5 Width of full size bed	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

EXHIBIT 8 Showing the Total Number of Responses on the Basis of "N" (No Number), "1" (School), "2" (Experience), and "3" (Guess) for Boys and Girls, City and Rural, for Texas

TEXAS - 251

City - 132 Rural - 119

	Boys-53					Girls-79					Boys-65					Girls-54				
	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T
I- 1 Farmland	0	24	24	0	48	1	25	38	3	67	1	12	45	4	62	0	23	23	3	49
I- 2 Potatoes	0	13	32	5	50	1	18	43	13	75	1	11	49	1	62	2	19	30	3	54
I- 3 Cotton lint	1	1	1	5	8	0	5	3	17	25	0	4	14	8	26	0	0	1	10	11
I- 4 Eggs	0	12	35	4	51	1	18	44	11	74	0	23	40	1	64	1	16	37	0	54
I- 5 Coal	0	19	22	3	44	0	18	24	20	62	0	15	27	12	54	2	16	15	15	48
I- 6 Nails	0	12	20	11	43	1	6	19	30	56	1	7	41	5	54	2	6	16	17	41
I- 7 Wood	1	5	22	8	36	1	13	25	14	53	0	9	35	0	44	3	7	26	7	43
II- 1 Inches in a foot	0	30	16	3	49	3	66	2	1	72	0	51	11	1	63	1	45	7	0	53
II- 2 Seconds in a minute	1	31	12	1	45	1	55	9	2	67	1	38	21	2	62	1	41	9	1	52
II- 3 Cups of milk in pint	2	14	13	6	35	1	20	15	14	50	2	23	11	9	45	0	25	5	5	35
II- 4 Cubic Inches in Cubic foot	0	11	0	0	11	1	8	2	2	13	1	7	2	1	11	0	4	0	1	5
II- 5 Acres in $\frac{1}{4}$ Section	0	4	4	0	8	0	2	0	2	4	0	2	2	3	7	0	1	0	0	1
II- 6 Pounds in bushel of wheat	0	2	5	6	13	2	5	0	6	13	0	3	1	6	10	0	2	0	6	8
II- 7 Pennyweight in an ounce	0	1	0	1	2	0	2	0	1	3	0	0	0	2	2	0	1	0	0	1
II- 8 Dozen eggs in a crate	1	1	1	0	3	0	0	0	1	1	0	0	6	0	6	0	2	0	0	2
II- 9 Rods in a mile	0	8	2	1	11	1	6	0	2	9	2	7	1	3	13	3	7	0	2	12
II-10 Pecks in a bushel	0	21	7	4	32	0	35	4	4	43	2	29	10	2	43	0	21	4	7	32
II-11 Wheat yield per acre	0	0	3	9	12	0	0	1	10	11	0	1	10	5	16	0	0	1	7	8
II-12 Cotton yield per acre	0	0	4	5	9	0	0	2	6	8	0	0	2	5	7	0	0	0	7	7
III-1 Height of dining-room table	0	0	0	2	2	0	0	0	4	4	0	0	0	5	5	0	0	0	4	4
III-2 Height of living-room ceiling	0	0	8	15	23	1	0	2	18	21	1	1	7	14	23	0	3	4	10	17
III-3 Width between rails of railroad	0	0	4	8	12	0	0	2	5	7	0	0	1	7	8	0	0	1	7	8
III-4 Glove size of average man	2	0	2	9	13	1	0	1	30	32	0	0	3	13	16	0	0	0	9	9
III-5 Width of full size bed	0	0	3	3	6	0	0	0	1	1	0	0	1	2	3	0	0	0	3	3

EXHIBIT 9 Showing the Distribution on Section I of the Correct Responses for Boys and Girls in Each Grade, City and Rural, for Texas.

Texas

City

Section I	Amarillo B	Amarillo G	Corpus Christi B	Corpus Christi G	Dallas B	Dallas G	El Paso B	El Paso G	Fort Worth B	Fort Worth G	Houston B	Houston G	Pampa B	Pampa G	San Antonio B	San Antonio G	Weslaco B	Weslaco G	Total B	Total G	Total Both
1- Farmland																					
Gr 2	0	2				1													0	1	1
3	8	5			3				1		1				1				6	0	6
4	6	11	1	1	2				1		2	1		4					5	7	12
5	9	12			2	4	2		1	4	2	0	2	2					9	10	19
6	8	13	1	1	5				2	3					1	1	2	4	6	13	19
7	7	9	3	2	1	2			1	1		2			2	1		1	7	9	16
8	11	15			1		1	1	2	2	2	2	1	1	1	1	4	7	11	15	26
9	3	11				5		1	2		1	5							3	11	14
10	1	1			1	1													1	1	2
	53	79	4	2	3	12	8	10	1	1	10	10	8	10	3	7	5	3	6	12	48	67	115
2- Potatoes																					
Gr 2	0	2				1													0	1	1
3	8	5			2	3			2	1	1				1	1			7	4	11
4	6	11	1	1	3			2	2	1	2	1		4					6	11	17
5	9	12			2	4	2		1	4	2		1	2					8	10	18
6	8	13	1	1	5	1			2	3					1	1	2	4	7	13	20
7	7	9	3	2	1	2			1	1		2			2	1		1	7	9	16
8	11	15			1		1	1	2	2	2	2	1	1	1	1	4	7	11	15	26
9	3	11						1	2		1	5							3	11	14
10	1	1				1	1												1	1	2
	53	79	4	2	3	15	9	10	1	3	12	12	8	10	2	7	5	4	6	12	50	75	125
3- Cotton lint																					
Gr 2	0	2																	0	0	0
3	8	5				1				1						1			1	2	3
4	6	11				1					1		1						0	3	3
5	9	12				2		1		4	1		1						2	7	9
6	8	13													1	1	1		1	2	3
7	7	9	1	1		2				1	1		1		1			1	2	7	9
8	11	15					1			1		1				1			2	2	4
9	3	11						1											0	1	1
10	1	1																	0	1	1
	53	79	1	1		6	3	1		2	7	1	3	1		1	3	1	2		8	25	32
4- Eggs																					
Gr 2	0	2				1													0	1	1
3	8	5			2	3			2	1	1				1	1			7	4	11
4	6	11		1	3			1	2	1	2	1		4					6	10	16
5	9	12		1	1	4	3		1	4	2		2	2					9	10	19
6	8	13		1	5	1			2	3					1	1	2	4	7	13	20
7	7	9	3	2	1	2			1	1		2			2	1		1	7	9	16
8	11	5			1		1	1	2	2	2	2	1	1	1	1	4	7	11	15	26
9	3	11				5		1	2		1	5							3	11	14
10	1	1				1	1												1	1	2
	53	79	3	2	3	14	9	11	1	2	12	12	8	10	3	7	5	4	6	12	51	74	125
5- Coal																					
Gr 2	0	2				1													0	1	1
3	8	5			2	2			2						1				4	3	7
4	6	11	1		2				2	1	1			4					4	7	11
5	9	12			2	4	3		1	4			2	2					6	11	17
6	8	13	1	1	3	1			2	3					1	2	3		6	10	16
7	7	9	3	2	1	2			1	1		1			2	1		1	7	8	15
8	11	5	1	1	1		1	1	2	1	2	2	1	1	1	1	4	7	11	14	25
9	3	11				3		1	2		1	5							3	9	12
10	1	1			1	1													1	1	2
	53	79	4	2	2	12	8	9	1	1	11	10	4	8	3	7	3	4	6	11	42	64	106
6- Nails																					
Gr 2	0	2				1													0	1	1
3	8	5			1	2			2	1	1				1				6	3	9
4	6	11		1	2				2	1			3						4	5	7
5	9	12	2	1	2	4	3		1	2	1		2	1					8	8	16
6	8	13	1	1	5	1			1	3		1			1	1	2	3	6	13	19
7	7	9	3	2	1	2			1	1					1	1		1	6	7	13
8	11	5					1	1	1	3	2	2	1	1		1	4	6	9	14	23
9	3	11				2			2		1	2							3	4	7
10	1	1			1														1	1	2
	53	79	3	2	3	12	8	8	1		10	10	6	6	3	5	3	3	6	10	43	56	99
7- Wood																					
Gr 2	0	2																	0	0	0
3	8	5			2	1			1	1	1				1				4	3	7
4	6	11		1	2				1		2			3					4	5	9
5	9	12	2	1	2	1	2		1	2	1		1						4	6	10
6	8	13	1	1	5	1			1	3					1	2	1		5	10	15
7	7	9	2	1	2					1		2			2	1			5	7	12
8	11	5	1	1	1		1	1	1	3	3	1	1	1		1	4	5	10	13	23
9	3	11				2		1	2		1	5							3	8	11
10	1	1				1													1	1	2
	53	79	2	1	3	14	4	6	1	1	7	10	8	8	2	4	3	3	6	6	36	53	89

Rural

Section I	Beulah B	Beulah G	Douglass B	Douglass G	Elgin B	Elgin G	Jefferson B	Jefferson G	Keene B	Keene G	Salmon B	Salmon G	Total B	Total G	Total
1- Farmland															
Gr 2													0	0	0
3	1			2	4	1			8	2	1	1	14	4	18
4		2		2	3				5	4			8	8	16
5				1			2	2	6	6			8	11	19
6			2	2			1	2	5	2	3		11	6	17
7					2	3	2		3	8		1	7	12	19
8						3	5	4	3	5	2		9	5	14
9													3	3	8
10													0	0	0
	1	2	2	5	9	9	14	7	32	24	4	2	62	49	111
2- Potatoes															
Gr 2													0	0	0
3	1				3	1			8	5	1	1	13	7	20
4		3	1	2	3				5	4			9	9	18
5				1			2	2	6	6	0	0	8	11	19
6			2	2				1	2	5	2	3	0	11	6	17
7					2	3	2		3	8		1	7	12	19
8							1	4	3	5	2		9	6	15
9							3	5					3	3	8
10													0	0	0
	1	3	3	5	8	10	14	7	32	27	4	2	62	54	116
3- Cotton lint															
Gr 2													0	0	0
3									2	1	1		3	1	4
4					1				2	1			3	1	4
5							1	1	2	1			3	2	5
6			2	1				1	2		1		5	2	7
7									1	3			1	3	4
8							3	1	4	1			7	2	9
9							4						4	0	4
10													0	0	0
		2	1	1			8	3	13	7	2		26	11	37
4- Eggs															
Gr 2													0	0	0
3	1				3	1			10	5	1	1	15	7	22
4		3	1	2	3				5	4			9	9	18
5				1		2	2	2	6	6			8	11	19
6			2	2			1	2	5	2	3		11	6	17
7					2	3	2		3	8		1	7	12	19
8						1	4	3	5	2			9	6	15
9						3	5						3	3	8
10													0	0	0
	1	3	3	5	8	10	14	7	34	27	4	2	64	54	118
5- Coal															
Gr 2													0	0	0
3	1				2	1			10	2	1		14	3	17
4		3		2					5	3			6	8	14
5				1			1	2	6	5			8	9	17
6			1	2			1	1	5	2	3		10	5	15
7					2	3	2		3	8		1	7	12	19
8						1	4	3	3	2			6	6	12
9						3	5						3	3	8
10													0	0	0
	1	3	1	5	4	9	14	6	32	22	4	1	56	46	102
6- Nails															
Gr 2													0	0	0
3	1				2				8	2	1	1	12	3	15
4		3		1	2				4	3			6	7	13
5						1	2	2	4	5			6	8	14
6			2	2			1	1	4	2	3		10	5	15
7					2	3	2		3	7		1	7	11	18
8						3	5						8	4	12
9													3	3	8
10													0	0	0
	1	3	2	3	6	7	14	6	27	20	4	2	54	41	95
7- Wood															
Gr 2													0	0	0
3	1				2	1			1	2	1	1	5	4	9
4		3		1	3				1	1			4	5	9
5						2	2	2	5	4			7	8	15
6			2	2			1	1	4	2	3		12	5	17
7							3	2	3	8		1	5	12	17
8							1	4	3	3	2		7	6	13
9							3	4					4	3	7
10													0	0	0
	1	3	2	3	7	10	13	6	17	19	4	2	44	43	87

Step V The data for the same five states were tabulated by grades. Exhibit 9 (page 38) shows the raw scores for each grade, both city and rural, with boys and girls kept separate. With the scores distributed in this way a check could be made on the grade of any one city or town for each item of Sections I, II and III of the questionnaire. The grade number is placed in column 1. Columns 2 and 3 show the number of pupils in each grade for boys and girls respectively. Column 4 shows, by grades, the total for boys and girls. The numbers above B (boys) and G (girls) indicate the total number of pupil responses. For instance, in Fort Worth (under city) there are 14 boys and 13 girls. Of the 14 boys one in each grades three, four, five and seven, while two in each of grades six, eight and nine answered correctly. The ten at the bottom of the column shows the total number of correct responses for the boys of Fort Worth. This represents 71.4 percent of the total of 14 boys. A similar story could be told for the girls and for each of the other cities and towns. The first two columns of the section headed "Total" represent for boys and girls, in both city and rural, the total number of responses for each, grade by grade, with a grand total at the bottom of each column. For instance, in grade four, five boys of the total of six boys for the grade (column 2 to the left) answered correctly. Seven girls of the total of 11 girls for the same grade answered correctly. A grand total of 48 boys of the 53 boys answered correctly, while 67 girls of the 79 answered correctly.

The third column contains the raw scores, grade by grade, for

EXHIBIT 10 Showing the Data of the Total Columns of Exhibit 9 in Percentage Form.

Texas – City

	Boys (53)										Girls (79)									
No. in Grade	0	8	6	9	8	7	11	3	1	(53)	2	5	11	12	13	9	15	11	1	(79)
Grade	2	3	4	5	6	7	8	9	10	Total	2	3	4	5	6	7	8	9	10	Total
Section I																				
1-Farmland	0.0	75.0	83.3	100.0	75.0	100.0	100.0	100.0	100.0	90.6	50.0	0.0	63.6	83.3	100.0	100.0	100.0	100.0	100.0	84.8
2-Potatoes	0.0	87.5	100.0	88.9	87.5	100.0	100.0	100.0	100.0	94.3	50.0	80.0	100.0	83.3	100.0	100.0	100.0	100.0	100.0	94.9
3-Cotton lint	0.0	12.5	0.0	22.2	12.5	28.6	18.2	0.0	0.0	15.1	0.0	40.0	27.3	58.3	15.4	77.8	13.3	9.1	100.0	31.6
4-Eggs	0.0	87.5	100.0	100.0	87.5	100.0	100.0	100.0	100.0	96.2	50.0	80.0	90.9	83.3	100.0	100.0	100.0	100.0	100.0	93.7
5-Coal	0.0	50.0	66.7	88.9	75.0	100.0	100.0	100.0	100.0	69.8	50.0	60.0	63.3	90.8	76.9	88.9	93.3	81.8	100.0	62.0
6-Nails	0.0	75.0	66.7	88.9	75.0	85.7	81.8	100.0	100.0	81.1	50.0	60.0	45.4	66.7	100.0	77.8	93.3	36.4	100.0	70.9
7-Wood	0.0	50.0	66.7	44.4	62.5	71.4	90.9	100.0	100.0	67.9	0.0	60.0	45.4	50.0	76.9	77.8	86.7	72.7	100.0	67.1
Section II																				
1-Inches in a foot	0.0	62.5	100.0	100.0	87.5	100.0	100.0	100.0	100.0	92.4	0.0	80.0	72.7	100.0	100.0	100.0	100.0	90.9	100.0	91.1
2-Seconds in a minute	0.0	50.0	66.7	100.0	87.5	100.0	90.9	100.0	100.0	84.9	0.0	20.0	72.7	75.0	100.0	100.0	100.0	100.0	100.0	84.8
3-Cups milk in a pint	0.0	25.0	66.7	100.0	100.0	57.1	63.6	33.0	0.0	66.0	0.0	20.0	36.4	66.7	61.5	88.9	86.7	72.7	0.0	63.3
4-Cubic Inches in a cubic foot	0.0	0.0	0.0	22.2	25.0	42.9	36.4	0.0	0.0	20.8	0.0	0.0	9.1	16.7	46.1	11.1	13.3	9.1	0.0	16.5
5-Acres in a quarter section	0.0	0.0	0.0	0.0	0.0	14.3	36.4	100.0	0.0	15.1	0.0	0.0	0.0	0.0	7.7	11.1	6.7	9.1	0.0	5.1
6-Pounds in a bushel of wheat	0.0	0.0	0.0	0.0	37.5	28.6	45.4	100.0	0.0	24.5	0.0	0.0	0.0	25.0	7.7	11.1	13.3	9.1	0.0	16.5
7-Penny weight in an ounce	0.0	0.0	0.0	22.2	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	8.3	0.0	11.1	0.0	9.1	0.0	3.8
8-Dozen eggs in a crate	0.0	0.0	0.0	0.0	12.5	0.0	0.0	66.7	0.0	5.7	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0	1.3
9-Rods in a mile	0.0	16.7	0.0	0.0	25.0	14.3	54.5	33.0	0.0	20.7	0.0	0.0	18.2	0.0	0.0	11.1	20.0	27.3	0.0	11.4
10-Pecks in a bushel	0.0	12.5	50.0	66.7	87.5	57.1	63.6	100.0	100.0	60.4	0.0	0.0	72.7	58.3	76.9	66.7	60.0	27.3	0.0	54.4
11-Good average yield of cotton per acre	0.0	0.0	0.0	0.0	50.0	0.0	45.4	66.7	100.0	22.6	0.0	0.0	9.1	16.7	30.8	22.2	13.3	0.0	0.0	13.9
12-Good average yield of wheat per acre	0.0	0.0	0.0	11.1	37.5	0.0	27.3	66.7	0.0	16.9	0.0	0.0	0.0	16.7	15.4	22.2	13.3	0.0	0.0	10.1
Section III																				
1-Height of dining-room table	0.0	0.0	0.0	0.0	12.5	14.3	0.0	0.0	0.0	3.8	0.0	0.0	0.0	16.7	15.4	0.0	0.0	0.0	0.0	5.0
2-Height of living room ceiling	0.0	0.0	0.0	11.1	75.0	85.7	72.7	66.7	0.0	43.4	0.0	20.0	0.0	25.0	30.8	22.2	46.7	27.3	100.0	26.6
3-Width between rails of railroad	0.0	0.0	0.0	33.3	37.5	14.3	27.3	66.7	0.0	22.6	0.0	0.0	0.0	8.3	15.4	11.1	13.3	9.1	0.0	8.9
4-Glove size of average man	0.0	12.5	0.0	0.0	0.0	42.9	54.5	66.7	100.0	24.5	0.0	20.0	36.4	41.7	69.2	33.3	26.7	45.4	100.0	40.5
5-Width of full size bed	0.0	0.0	0.0	0.0	25.0	28.6	9.1	0.0	100.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	0.0	1.3

boys and girls combined. It is read thus. One pupil of the 2 pupils (column 4 to the left) in grade two answered correctly. Six pupils of the 13 pupils in grade three answered correctly, while 19 of the 21 pupils in grade six answered correctly. 115 pupils of the total of 132 pupils for the city answered correctly. Each item is read in the same way. The data for the rural are tabulated and read in the same way. The total columns were turned into percentages as shown in Exhibit 10, (page 40). This had to be done before any interpretations could be made.

Tables and Figures appearing in the following chapters were compiled from these data sheets, portions of which are shown in the exhibits of this chapter.

CHAPTER IV

DISTRIBUTION OF DATA BY STATES

A distribution of the different and correct responses among the 43 states and the District of Columbia is presented in this chapter for the purpose of finding answers to (1) the measures known by children, (2) why they know them, and (3) the ability to apply measurement. The most common answer for each item is also given consideration.

Each of the three sections reveals some interesting facts. Of the 24 items of these sections, the most common answers to 19 of them were correct. All of Section I, all but two of Section II, and only two of Section III were correct responses.[1] The most common answer for four items of this study differ from the same items of the Wilson study.[2] Each of these will be noted carefully in the discussion which follows as each section is given separate treatment. The data used have been taken from the tabulations illustrated by the exhibits in Chapter III. A portion of these data is shown in Table I page 43 .

Section I

Section I contains very familiar commodities. It seeks

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1. The correct responses with the wrong answers and the most common answer for the items in Sections I, II and III are given in Appendix B (page 165).

2. Wilson, D. Op. Cit. pp. 30, 31.

TABLE I Shows the total number of different answers and the most common answer on the various items of Sections I, II, and III for the 43 states and District of Columbia

Item	Total Number of Different Answers	Most Common Answer	Number for Most Common Answer	Percentage for Most common Answer
I- 1 Farmland	36	Acre	6020	91.5
I- 2 Potatoes	52	Pound	2255	34.3
I- 3 Cotton lint	76	Pound	1812	27.5
I- 4 Eggs	22	Dozen	6082	92.5
I- 5 Coal	56	Ton	4980	75.8
I- 6 Nails	69	Pound	3940	59.9
I- 7 Wood	79	Cord	2656	40.4
II- 1 Inches in a Foot	27	12	5973	90.8
II- 2 Seconds in a Minute	39	60	5695	85.8
II- 3 Cups of Milk in Pint	31	2	4633	70.5
II- 4 Cubic Inches in Cubic Foot	218	1728	1078	16.4
II- 5 Acres in $\frac{1}{4}$ Section	162	160	547	8.3
II- 6 Pounds in a Bushel of Wheat	139	60	824	12.5
II- 7 Pennyweight in an Ounce	76	16	352	5.4
II- 8 Dozen Eggs in a Crate	121	12	1288	19.4
II- 9 Rods in a Mile	406	320	937	14.2
II- 10 Pecks in a Bushel	59	4	3832	58.2
II- 11 Average Yield of Cotton per Acre	416	1 bale	177	2.7
II- 12 Average Yield of Wheat per Acre	402	60 bushel	112	1.7
III- 1 Height of Dining-room Table	205	3 feet	1524	21.6
III- 2 Height of Living-room ceiling	259	8 feet	736	11.2
III- 3 Width Between Rails of Railroad	251	3 feet	886	13.5
III- 4 Glove Size of Average Man	228	Size 8	480	7.3
III- 5 Width of Full Size Bed	357	4 feet	613	9.5

information concerning the way in which they are sold. Are children acquainted with them? Careful examination of each item will tell the story.

I-1 Farmland Acre is the most common answer, carrying 91.5 percent of all the answers given. It is apparent that these children do have a knowledge of the way in which farmland is sold. There was only one other correct answer given, that of section which appeared only once. The total number of wrong answers is 34, among which are lot, plot, and acre-lots. The pupils who gave these were apparently thinking of plots of ground used for building purposes. Farmland is not sold in this way.

I-2 Potatoes This item shows varying answers for different parts of the country. There were three outstanding answers given as the following figures and percentages indicate.

	Pound	Bushel	Peck
Number of answers	2255	1836	894
Percent of answers	34.3	27.9	13.6

These three represent 75.8 percent of the total of 94.5 percent of correct answers as shown in Table II (P. 45). There are combinations of these three answers which are not shown here. It is noted that pound carries the highest percent, almost as high as the other two.

TABLE II Shows the sum of the various answers considered correct and Percentage of the total answers for the same, for each item in Sections I, II, and III for the 43 states and District of Columbia

ITEM		Number	Percent
I- 1	Farmland	6021	91.6
I- 2	Potatoes	6211	94.5
I- 3	Cotton lint	1812	27.5
I- 4	Eggs	6261	95.2
I- 5	Coal	5484	83.4
I- 6	Nails	4512	68.5
I- 7	Wood	4020	61.2
II- 1	Inches in a foot	5973	90.8
II- 2	Seconds in a minute	5695	85.8
II- 3	Cups of milk in a pint	4633	70.5
II- 4	Cubic Inches in a cubic foot	1078	16.4
II- 5	Acres in a quarter section	547	8.2
II- 6	Pounds in a bushel of wheat	824	12.5
II- 7	Pennyweight in an ounce	244	3.7
II- 8	Dozen Eggs in a crate	405	6.1
II- 9	Rods in a mile	937	14.2
II- 10	Pecks in a bushel	3832	58.2
II- 11	Averave Yield of Cotton per acre	309	4.7
II- 12	Average Yield of Wheat per acre	704	10.7
III- 1	Height of dining-room table	553	8.3
III- 2	Height of living-room ceiling	2508	38.1
III- 3	Width between rails of railroad	1280	19.4
III- 4	Glove size of average man	2113	32.1
III- 5	Width of a full size bed	366	5.6

combined. This is different from the findings of the Wilson study,[1] in which peck carried the highest frequency with a percentage of 70.0 for the elementary grades (grades 3-6) and 77.0 percent for the junior high school. All of the pupils in her study were from New England (Massachusetts) whereas 43 states and the District of Columbia are represented in this study. In New England (Maine, New Hampshire, Massachusetts, Connecticut and Rhode Island) of this study 45.5 percent of the pupils gave peck as the most common answer, while only 4.5 percent gave pound. In Massachusetts alone 43.3 percent answered peck against 4.4 percent who answered pound. This compares favorably to the Wilson study; the two studies are not in conflict. The present study has a better opportunity of noting sectional differences.

It is apparent then that pound is an answer which is common to some other part of the country. The following states gave pound as the most common answer.

	Pound	Bushel	Peck
Alabama	32	6	1
Arizona	44	8	1
California	680	176	39
Colorado	181	68	14
Florida	116	67	10
Idaho	34	7	0
Kentucky	12	9	6
Louisiana	32	6	1
Montana	16	6	2

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1. Wilson D. Op. Cit. p. 30.

	Pound	Bushel	Peck
New Mexico	48	8	0
Oklahoma	53	43	34
Oregon	189	60	2
Texas	133	79	7
Washington	148	30	2
Wyoming	18	1	2
Total	1736	574	121
Percent	52.7	17.4	3.6

It will be noted that pound carries 52.7 percent against 17.4 percent for bushel and 3.6 percent for peck. These states are located in the West and South. The state of California alone, with 1372 returns carries 50.0 percent for pound against 2.8 percent for peck. The next group of states listed peck as the most common answer.

	Peck	Bushel	Pound
Connecticut	19	5	3
Illinois	112	41	25
Indiana	52	30	21
Iowa	39	24	10
Kansas	17	3	15
Maryland	4	2	1
Massachusetts	78	50	8
Rhode Island	13	3	1
South Carolina	2	0	1
Total	336	158	85
Percent	49.6	22.0	11.8

Almost 50 percent of the answers are for peck. It is more than twice the percent for either of the two measures.

Bushel was given as the most common answer for the next group of states.

	Bushel	Peck	Pound
Arkansas	36	9	23
Georgia	22	11	7
Maine	12	8	0
Michigan	232	142	31
Minnesota	62	17	6
Missouri	37	19	33
Nebraska	40	34	13
New Hampshire	5	2	0
New York	48	35	39
North Carolina	28	3	23
North Dakota	7	0	1
Ohio	181	61	62
Pennsylvania	83	31	41
South Dakota	12	9	3
Tennessee	63	8	43
Virginia	63	10	29
West Virginia	15	6	6
Wisconsin	96	29	15
Total	1042	434	375
Percent	44.7	18.6	16.1

Bushel is apparently the most common measure used in purchasing or selling potatoes in these parts of the country. The states are located mainly in the Middle west, the East and the northern part of the South. The District of Columbia's answers centered in bushel and pound with 52 and 53 respectively. Mississippi gave the same number to peck and pound. The total number of different answers is 52.

I-3 Cotton lint This item carries 76 different answers, 75 of which are wrong answers. There is only one correct answer and that is pound. Cotton lint may be packed in bales but is bought and sold on the pound basis. The two main answers are given with pound as the most common one. There is not so much difference between the two as the following data show:

	Pound	Bale
Number	1812	1329
Percent	27.5	20.2

These percents are not so high as those for farmland and potatoes, which indicates that these children are not as familiar with the way in which cotton lint is sold.

I- 4 Eggs Dozen, a correct answer and the most common one for eggs, carries 92.5 percent, a larger percent than that for any other item. The percent is not as large as the percent of 95.2 for the correct responses as shown in Table II. This is due to the fact that there are other correct responses aside from dozen. The next most common answer is pound with a percentage of 2.4. This is also a right answer. Personal experience is the basis for its acceptance as such. They are sold in this way in Michigan. Only 22 different answers are given. The large percentage and narrow spread of answers given are an indication that these children are very familiar with the way in which eggs are sold.

I- 5 Coal The most common answer for coal is ton which carries 75.8 percent of all the answers. The next most common answer is pound with 7.0 percent. There were a few answers combining the two. With these and the two answers pound and ton we have a percentage of 83.4 of correct responses, as shown in Table II.

I- 6 Nails There are two correct responses for nails, pound and keg. These are also the ones which carry the greatest frequency as indicated below.

	Pound	Keg
Number	3940	486
Percent	59.9	7.4

Pound carries the highest number with 59.9 percent while keg has only 7.4 percent. These two percents do not equal the total percent of

68.5 for correct answers as shown in Table II, due to the fact that in a few instances a combination of pound and keg was given as an answer. A builder may buy nails by the keg; the farmer or householder will buy a few pounds or less at a time.

I- 7 Wood The most common answer for wood is cord with 40.4 percent, which is practically two-thirds of the 61.2 percent of correct answers as shown in Table II. It will be noted that pound is listed among the answers accepted as correct. In some sections of the country where wood is rather scarce it is sold in this way. The states of New Mexico and Arizona carry a number of answers for pound.

Section II

Section II contains for the most part measures and denominate numbers commonly found in the arithmetic textbooks and taught in school. What children know concerning them will be shown by noting each item separately.

II- 1 Inches in a foot The number 12 represents 90.8 percent of the 27 answers given. Those who gave 36 as an answer no doubt had in mind the number of inches in a yard, while those who gave 144 were thinking of the number of square inches in a square foot. The other answers would indicate mere guesses.

II- 2 Seconds in a minute It would seem that every child should know the number of seconds in a minute. But this is not true, at least for this group, as 85.8 percent of them answered 60 which is the only correct answer. The range of answers is from $\frac{1}{2}$ to 520, with 39 different answers being given.

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II- 3 Cups of milk in a pint Again the most common answer is a correct one. 70.5 percent of the children answered 2. A total of 31 different responses were given with a range from $\frac{1}{2}$ through 6728. The number 1728 would seem to indicate that the pupils who answered thus intended it for the next item, the number of cubic inches in a cubic foot. Only a very few were given.

II- 4 Cubic inches in a cubic foot A variety of answers were given for this item with a total of 218 different answers. The smallest number is 1 and the largest is 20736. The two most common answers are:

	1728	144
Number	1078	859
Percent	16.4	13.1

The percentages for both are small. Those who answered 144 were apparently thinking of the number of square inches in a square foot. The low percentage for 1728 would seem to indicate that very few remember it even though it is taught in school. Non-usage evidently accounts for the forgetting that occurs.

II- 5 Acres in $\frac{1}{2}$ section This item also ahows quite a variety of answers with a total of 162 different answers. Aside from figures ranging from 1/25 to 200000, 1200 yards, ton, square miles and $17.28 appeared among the responses. The three most common answers are:

	160	640	320
Number	547	66	13
Percent	8.3	1.0	.2

The correct answer 160 carries the highest percent, 8.3, although it is very small. Those answering 640 no doubt had in mind the number of acres in a section while those who gave 320 as an answer were thinking of the number of rods in a mile which is asked for in item II- 9. Many attempted no answer, leaving it blank. This is also true for items II- 6, II- 7, II- 8, II- 9, II- 11 and II- 12, especially in the lower grades.

II- 6 Pounds in a bushel of wheat Here the most common answer is 60 which carries only 12.5 percent. The range of the numbers given as answers is from $\frac{1}{2}$ to 30,000,000. The other answers, except 50 bale, have some association to bushel or wheat. For instance, 4 pecks is the number in a bushel, while 1 peck is a portion of a bushel. The total number of different answers is 139.

II- 7 Pennyweight in an ounce The most common answer is not the correct one, 20, as shown by the following data.

	16	20	12
Number	352	244	185
Percent	5.4	3.7	2.8

The Wilson study[1] found 20 to be the most common answer with the percentage of correct responses as follows:

	Percent
Grade total (grades 3-6)	1.6
Junior high total (grades 7-9)	4.3
Grade 10	1.2

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1. Wilson, D. Op. Cit. pp. 41, 72.

The 3.7 percent of correct responses in this study is higher than those in her study except for the junior high which in turn is slightly higher. The next most common answer in her study is 12 which is third in the present study. The children in her study were from Massachusetts whereas those in this study cover practically the entire country. Of all the items of Section II this one carries the smallest percentage of correct responses followed in order by II- 11, II- 8, II- 5 and II- 12. This is not surprising as it is a measure little used, except in specialized business.

II- 8 Dozen Eggs in a crate A total of 121 different answers were given. The range is from $\frac{1}{2}$ through 600,000. Other responses are 5 dozen, 1 gross, 2 pounds, 18 eggs, and 6 feet. Those referring to pound, dozen, and gross might have some association to eggs but surely 6 feet has none. Many of the numbers indicate guesses. The three with the highest frequency are shown here:

	12	24	30
Number	1288	509	405
Percent	19.4	7.7	6.1

These differ somewhat from the Wilson study[1] which lists the three in order thus, 12, 30, and 24. In both studies the percentages are low. There are 12 dozen and also 24 dozen eggs in a case, but 30 is the only correct answer for the number of dozen in a crate.

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1. Wilson, D. Op. cit. pp. 41, 71

II- 9 Rods in a mile This item of measurement, along with II- 11 and II- 12, shows very wide variation of answers. The total of different answers for this one is 406, with numbers ranging from 1 through 100,000. Those carrying the highest frequency are:

	320	160	640
Number	937	157	68
Percent	14.2	2.4	1.0

Although small, the correct answer, 320, carries the highest percent. Apparently the answers 160 and 640 were confused with item II- 5, acres in a quarter section, the 160 being the correct answer for it and 640 the number of acres in a section. The majority of the children in the lower grades attempted no answer at all.

II- 10 Pecks in a bushel There is a fair agreement on the answer for this item as might be expected as this is a commonly used measure. Number 4, the correct answer, carries 58.2 percent of all the responses. The next most common answer is 8 with a percentage of 8.8.

II- 11 Average yield of cotton per acre The 416 different answers centered in figures ranging from 1/7 to 50,000, and numbers expressed in terms of pounds, bales, bushel, ton, sack, feet, acre, mile, peck, yard, gallon, ounce and dollars and cents. A look at the different responses would indicate that the majority were mere guesses. The answers with the highest frequency were all related to pound and bales. Apparently some of the children sensed that these two measures were

associated with cotton but had little conception, in some instances, of the correct amount. The following figures and percentages show the answers with the highest frequency.

	1 bale	2 bale	100 pounds	3 bale	½ bale
Number	177	84	50	41	34
Percent	2.7	1.3	.8	.6	.5

One bale, a correct response, has the highest frequency although it carries a very small percentage. The next highest is 2 bale, not a correct response. The most nearly correct answer of the five, ½ bale, carries the lowest percentage. The total percent for the correct responses 1 bale, 100 pounds and ½ bale is 4.0. This is less than the total percent of correct responses for this item as shown in Table II (page 45). This is due to the fact that other "fair estimate" responses not listed here, as 500 pounds and ½ bale, are included in the 4.7 percent. Chapter V will show the states leading in the percentage of correct responses on this item. See data on yield of cotton in Appendix D.

II- 12 Average Yield of Wheat Per Acre The distribution of the 402 different answers on yield of wheat is similar to those on yield of cotton. The figures range from 1/12 through 50,000. Other answers include varying amounts in relation to the measures bushel, pound, ton, sack, yard, peck, gallon, foot, feet, quart, percent, bale, acre, mile, and dollars and cents. Answers carrying the highest frequency are all in terms of bushel. The five most common answers

are shown here:

	60 bushel	50 bushel	20 bushel	40 bushel	30 bushel
Number	112	103	94	92	71
Percent	1.7	1.5	1.4	1.4	1.1

These five answers account for 7.1 percent of the total of 10.7 percent of correct responses as shown in Table II (page 45). Many of the figures given come within the range of the number of bushels accepted as correct responses. These would seem to indicate that there was failure on the part of these children to write the word bushel beside them. See data on yield of wheat in Appendix D.

Section III

Section III gives an opportunity for estimating distances, heights and widths. How efficiently these children are able to do this will be shown by the data on the five items of this section.

III- 1 Height of Dining-room table There were 205 different answers given. The majority of them are related to yard, feet and inches. The range for inches is from 1 through 100, for feet from 1 through 400, and for yards $\frac{1}{2}$ through 13. The most common answers are:

	3 feet	4 feet	$3\frac{1}{2}$ feet	$2\frac{1}{2}$ feet
Number	1524	427	373	341
Percent	21.6	6.5	5.7	5.2

The only correct answer of the four is $2\frac{1}{2}$ feet which carries the smallest percentage. Table II (page 45) shows that only 8.3 percent gave the correct answer. Three feet, with the highest frequency, 4 feet and $3\frac{1}{2}$ feet, the two next highest, are not reasonable answers. The Wilson study[1] shows 3 feet to have the highest frequency with 4 feet coming second. The two studies agree in that the two most common answers are the same. It is evident that these children have not been taught to develop clear concepts of units of distance and to apply them to objects that are encountered daily.

III- 2 Height of Living-room Ceiling Heights of living-room ceilings may vary somewhat in different parts of the country.

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1. Wilson, D. op. cit. p. 39

To care for this difference a fair estimate of from 7 to 10 feet inclusive was adopted as the basis for acceptable answers. Here are the number and percentage of those carrying the highest frequency:

	8 feet	9 feet	10 feet
Number	736	579	496
Percent	11.2	8.6	7.5

The most common answer is 8 feet with 11.2 percent. This differs from the findings of the Wilson study[1] in which 10 feet had the highest percentage. Many of the adults in her study answered 10 feet which tends to account for it being listed first. The total number of different answers is 259. These center largely in terms of inches, feet, and yards.

III- 3 Width between Rails of a Railroad Of the 251 different answers, there are two which predominate. These are 3 feet with 13.5 percent and 4 feet with 12.3 percent. The 3 feet is not a reasonable answer while 4 feet was accepted as such. Of the 6573 children, a number of them gave 4 feet 8 inches as an answer, but only 3 children gave the exact measurement of 4 feet 8½ inches. Following are the data for these:

State	City	Sex	Grade	Age	Occupation of father
Florida	Pensacola	Girl	7	12	Electrical engineer
Florida	Pensacola	Girl	8	13	Electrical engineer
Florida	Fort Lauderdale	Girl	8	13	Grocer

1 Wilson, D. op. cit. p. 31.

The two girls from Pensacola are sisters. The father being an electrical engineer, no doubt, accounts for their correct responses. This is an item, the answer to which would be known only through experience. The girl from Fort Lauderdale doubtless gained her knowledge from some other source than her home, or at least her father's occupation would seem to indicate so.

III- 4 Glove Size of Average Man The most common replies for glove size are:

	8	7	9	$7\frac{1}{2}$
Number	480	306	271	80
Percent	7.3	4.6	4.1	1.2

All of these are reasonable responses. Size 8 has the greatest frequency. This is quite a fair answer but it carries a very small percentage, only 7.3 percent. The total percentage of reasonable responses is 32.1 as shown in Table II (page 45). The sizes vary from $\frac{1}{4}$ through 100,000. The latter would surely indicate a guess. Many answers relating to feet were given. Those clustering around 5 feet, such as 5 feet 8 inches, and 5 feet 9 inches, would indicate that those who gave these answers had in mind the height of the average man rather than glove size. Inches carried a number of answers from 1 through 110, none of which could possibly have been meant for a man's height. These must have been wild guesses. Other answers, such as those referring to mile, yard, and peck, have no relation to glove size. This item and III-2, height of living room ceiling, carry

larger percents than the other three items of this section.

III- 5 Width of Full size bed This item has 357 different answers. The correct answer is 54 inches. Answers with the greatest frequency are:

	4 feet	5 feet	6 feet
Number	613	599	408
Percent	9.5	9.3	6.2

None of these are correct replies. Table II (page 45) shows that only 5.6 percent correct answers were given. Of the three answers, 4 feet carries the highest percent with 5 feet as a close second. The Wilson study[1] shows 5 feet to be the most common answer. Since 4 feet and 5 feet carry practically the same percents, the findings of the two studies agree very favorably on this item. There were 357 different answers given for the width of a bed. Those centering in inches varied from $1\frac{1}{2}$ to 201, those for feet from 1 through 400, while those for yard ran from $\frac{1}{2}$ to $36\frac{1}{2}$. Those who gave answers in terms of pounds possibly were thinking of the weight of the bed rather than the width. Even if this were true such answers as 1 pound, 10 pounds and 600 pounds are unreasonable.

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1. Wilson, D., op. cit. pp. 31,40.

CHAPTER V

DISTRIBUTION OF DATA IN CITY AND RURAL

This chapter aims to show on a percentage basis, differences in responses of city and rural children. Following the census bureau's plan, a town or city of less than 2500 population is considered rural. Using this basis, it is realized, dissipates the returns from strictly rural children. The data for the 43 states and the District of Columbia for both city and rural sections have been included in Table III for the benefit of the reader who may wish to examine them. No attempt is made to discuss in detail each item for each state. Lack of space prohibits the inclusion of such a story. Items showing decided differences and interesting features will be given separate treatment.

It is seen from Table III that New Hampshire and North Dakota carry only rural returns while Arizona, Connecticut, Idaho, Louisiana, Maryland, Mississippi, Rhode Island, South Carolina, West Virginia, and the District of Columbia carry only city returns. This leaves 32 of the 43 states with both city and rural returns. These states carry the major portion of all returns as shown in Appendix A.

Table IV (page 73) summarizes the data of Table III. Column one contains a list of the 24 items of Sections I, II, and III of the questionnaire. Columns two and four give the percentages of correct responses for city and rural respectively based upon the total number of returns for each as indicated at the top of the columns. The probable error[1](P.E.) of

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1. For determining the Probable Error of a percent and the significance of the percentage difference, the Holzinger formulas 101 and 102 were used.

Table III Shows the Percentage of Correct Answers for Each Item in Sections I, II, and III, City and Rural, for the 43 States and the District of Columbia

Item		Alabama		Arizona		Arkansas		California		Colorado	
		C	R	C	R	C	R	C	R	C	R
I - 1	Farmland	92.5	87.5	88.9	----	88.0	100.0	92.7	95.0	100.0	89.7
I - 2	Potatoes	100.0	83.3	85.7	----	100.0	100.0	94.7	88.9	96.1	89.7
I - 3	Cotton lint	38.5	16.7	38.1	----	27.8	35.6	27.9	31.4	33.6	29.9
I - 4	Eggs	96.2	91.7	95.0	----	100.0	100.0	98.5	84.9	95.6	91.8
I - 5	Coal	96.2	95.8	57.1	----	88.9	96.6	65.0	75.1	93.2	92.8
I - 6	Nails	84.6	70.8	60.3	----	88.9	96.6	70.2	73.1	66.4	69.1
I- 7	Wood	61.5	75.0	50.8	----	94.4	91.5	55.8	70.6	51.7	37.1
II - 1	Inches in a foot	92.3	75.0	88.9	----	94.4	100.0	93.3	92.1	90.5	87.6
II - 2	Seconds in a minute	96.2	91.7	90.5	----	94.4	96.7	89.3	95.7	90.1	83.5
II - 3	Cups of milk in a pint	76.9	41.7	63.5	----	61.1	84.9	83.1	88.7	66.8	69.1
II - 4	Cubic Inches in cubic foot	30.8	25.0	3.2	----	38.9	54.2	16.4	16.2	15.8	17.5
II - 5	Acres in $\frac{1}{4}$ Section	7.7	0.0	3.2	----	11.1	40.7	5.3	8.5	12.2	12.4
II - 6	Pounds in a bushel of wheat	7.7	4.2	3.2	----	33.3	71.2	5.4	8.1	13.8	11.3
II - 7	Pennyweight in ounce	23.1	0.0	0.0	----	16.7	52.5	1.4	2.4	3.1	3.1
II - 8	Dozen eggs in a crate	0.0	0.0	0.0	----	5.6	35.6	3.1	6.3	4.7	3.1
II - 9	Rods in a mile	30.8	37.5	9.5	----	55.6	57.6	7.1	12.2	18.5	10.3
II - 10	Pecks in a bushel	73.1	33.3	52.4	----	83.3	96.6	53.9	56.6	62.0	55.7
II - 11	Wheat yield per acre	11.5	16.7	6.4	----	27.8	40.9	2.5	4.1	4.7	2.1
II - 12	Cotton yield per acre	0.0	0.0	6.4	----	33.3	30.5	6.6	8.3	17.3	19.6
III - 1	Height of dining-room table	11.5	4.2	1.6	----	16.7	16.9	9.3	8.5	8.7	5.2
III - 2	Height living-room ceiling	34.6	12.5	30.2	----	5.6	55.9	40.0	37.6	39.9	35.1
III - 3	Width between rails of railroad	7.7	16.7	11.1	----	11.1	28.3	19.6	24.5	19.3	18.6
III - 4	Glove size of average man	23.1	4.2	23.8	----	11.1	38.9	28.5	35.6	35.9	35.1
III - 5	Width of full size bed	7.7	0.0	11.1	----	3.4	28.8	4.9	4.8	4.7	5.2

Table III Cont.

Item	Connecticut C	Connecticut R	District of Columbia C	District of Columbia R	Florida C	Florida R	Georgia C	Georgia R	Idaho C	Idaho R
I- 1 Farmland	78.8	----	83.3	----	92.7	95.0	91.1	75.0	94.5	----
I- 2 Potatoes	84.8	----	92.4	----	95.3	100.0	91.1	100.0	95.9	----
I- 3 Cotton lint	15.2	----	8.3	----	29.0	5.0	20.0	0.0	20.6	----
I- 4 Eggs	84.8	----	93.2	----	94.8	95.0	95.6	75.0	94.5	----
I- 5 Coal	93.9	----	84.1	----	79.7	85.0	86.7	0.0	94.5	----
I- 6 Nails	45.5	----	59.8	----	78.2	80.0	60.0	50.0	78.1	----
I- 7 Wood	57.6	----	51.5	----	63.2	90.0	64.4	50.0	76.7	----
II- 1 Inches in a foot	81.8	----	96.2	----	84.5	65.0	91.1	100.0	82.2	----
II- 2 Seconds in a minute	84.8	----	83.3	----	88.6	95.0	88.9	25.0	89.0	----
II- 3 Cups of milk in pint	63.6	----	60.6	----	67.9	70.0	60.0	25.0	78.1	----
II- 4 Cubic Inches in cubic foot	15.2	----	7.6	----	22.8	40.0	13.3	0.0	13.7	----
II- 5 Acres in $\frac{1}{4}$ Section	0.0	----	3.8	----	22.3	10.0	17.8	0.0	27.4	----
II- 6 Pounds in bushel of wheat	6.1	----	3.8	----	17.6	15.0	25.6	25.0	19.2	----
II- 7 Pennyweight in ounce	3.0	----	2.3	----	17.1	5.0	15.6	0.0	9.6	----
II- 8 Dozen eggs in a crate	15.2	----	2.3	----	11.9	40.0	20.0	0.0	17.8	----
II- 9 Rods in a mile	9.1	----	6.8	----	17.6	15.0	31.1	0.0	24.7	----
II- 10 Pecks in a bushel	45.5	----	56.1	----	78.8	75.0	60.0	50.0	47.9	----
II- 11 Wheat yield per acre	0.0	----	3.0	----	4.6	0.0	0.0	0.0	9.6	----
II- 12 Cotton yield per acre	0.0	----	6.1	----	9.8	5.0	8.9	0.0	27.4	----
III- 1 Height of dining-room table	6.1	----	7.6	----	7.8	10.0	6.7	0.0	12.3	----
III- 2 Height of living-room ceiling	21.2	----	42.4	----	37.3	45.0	24.4	25.0	31.5	----
III- 3 Width between rails of railroad	15.2	----	19.7	----	29.0	35.0	17.8	0.0	24.7	----
III- 4 Glove size of average man	15.2	----	13.1	----	22.3	50.0	31.1	0.0	43.8	----
III- 5 Width of full size bed	0.0	----	6.8	----	23.5	5.0	6.7	0.0	8.2	----

Table III Cont.

	Illinois		Indiana		Iowa		Kansas		Kentucky	
	C	R	C	R	C	R	C	R	C	R
I- 1 Farmland	97.5	84.8	78.1	100.0	90.5	87.5	77.4	92.3	100.0	100.0
I- 2 Potatoes	95.9	97.5	92.7	100.0	98.4	87.5	90.3	92.3	100.0	100.0
I- 3 Cotton lint	20.7	24.1	25.2	23.5	23.8	58.3	29.0	15.4	70.4	33.3
I- 4 Eggs	97.5	92.4	93.5	100.0	100.0	95.8	90.3	100.0	100.0	100.0
I- 5 Coal	92.5	88.6	87.0	100.0	96.8	87.5	83.9	100.0	92.6	100.0
I- 6 Nails	69.4	67.1	67.5	76.5	73.0	66.7	58.1	92.3	77.8	33.3
I- 7 Wood	58.7	34.2	43.1	64.7	50.8	37.5	35.5	53.9	40.7	33.3
II- 1 Inches in a foot	95.1	98.7	88.6	100.0	96.8	100.0	93.6	92.3	85.2	100.0
II- 2 Seconds in a minute	90.9	82.3	91.9	82.4	85.7	87.5	96.8	84.6	92.6	100.0
II- 3 Cups of milk in a pint	70.2	75.9	57.7	76.5	77.8	90.8	56.1	76.9	59.3	100.0
II- 4 Cubic Inches in a cubic foot	21.5	16.5	4.9	11.8	14.3	4.2	25.8	7.7	3.7	0.0
II- 5 Acres in $\frac{1}{4}$ Section	8.3	5.1	0.0	5.9	9.5	12.5	6.5	15.4	0.0	0.0
II- 6 Pounds in bushel of wheat	9.9	8.9	8.9	17.7	23.8	8.3	12.9	23.1	25.9	33.3
II- 7 Pennyweight in ounce	.8	1.3	2.4	0.0	1.6	0.0	0.0	0.0	0.0	33.3
II- 8 Dozen eggs in a crate	1.7	6.3	2.4	11.8	3.2	33.3	0.0	23.1	7.4	0.0
II- 9 Rods in a mile	19.0	8.9	6.5	5.9	11.1	37.5	19.4	15.4	7.4	0.0
II- 10 Pecks in a bushel	66.9	64.6	56.9	76.5	69.8	75.0	87.1	61.5	66.7	66.7
II- 11 Wheat yield per acre	0.0	0.0	0.0	0.0	7.9	0.0	3.2	7.7	0.0	33.3
II- 12 Cotton yield per acre	11.5	18.9	.8	0.0	14.3	33.3	9.7	38.5	3.7	0.0
III- 1 Height of dining-room table	14.1	10.1	4.9	17.7	7.9	0.0	3.2	7.7	7.4	0.0
III- 2 Height of living-room ceiling	38.0	49.4	30.1	29.4	34.9	37.5	35.5	46.2	25.9	66.7
III- 3 Width between rails of railroad	23.9	24.1	15.4	23.5	11.1	29.2	25.8	23.1	7.4	33.3
III- 4 Glove size of average man	40.5	32.9	23.6	23.5	20.6	37.5	32.3	46.2	44.4	66.7
III- 5 Width of full size bed	3.3	3.8	3.3	0.0	7.9	4.2	12.9	7.7	3.7	0.0

Table III Cont.

Item		Louisiana		Maine		Maryland		Massachusetts		Michigan	
		C	R	C	R	C	R	C	R	C	R
I- 1	Farmland	89.6	----	93.8	85.7	83.3	----	84.9	91.8	90.6	91.4
I- 2	Potatoes	91.7	----	100.0	100.0	91.7	----	94.9	95.1	95.5	94.3
I- 3	Cotton lint	18.8	----	31.3	28.6	8.3	----	15.1	11.5	20.1	22.3
I- 4	Eggs	85.4	----	100.0	100.0	100.0	----	94.9	98.4	95.7	94.9
I- 5	Coal	62.5	----	100.0	71.4	91.7	----	84.9	95.1	93.3	93.5
I- 6	Nails	64.6	----	87.5	57.1	50.0	----	57.9	67.2	63.6	69.8
I- 7	Wood	50.0	----	75.0	85.7	50.0	----	61.3	68.9	59.3	76.3
II- 1	Inches in a foot	85.4	----	93.8	85.7	91.7	----	94.1	98.4	88.8	90.6
II- 2	Seconds in a minute	83.3	----	93.8	85.7	83.3	----	89.1	88.5	86.4	92.8
II- 3	Cups of milk in a pint	56.3	----	81.3	100.0	58.3	----	68.9	68.9	62.3	67.6
II- 4	Cubic Inches in a cubic foot	39.6	----	25.0	71.4	0.0	----	22.7	11.5	14.9	18.6
II- 5	Acres in $\frac{1}{4}$ Section	12.5	----	6.3	14.3	8.3	----	3.4	0.0	6.7	20.1
II- 6	Pounds in bushel of wheat	20.8	----	0.0	14.3	0.0	----	6.7	6.6	15.4	20.8
II- 7	Pennyweight in ounce	0.0	----	0.0	0.0	0.0	----	.8	0.0	2.0	2.9
II- 8	Dozen eggs in a crate	31.3	----	0.0	0.0	0.0	----	5.8	3.3	2.4	4.3
II- 9	Rods in a mile	31.3	----	12.5	0.0	0.0	----	12.6	1.6	14.5	21.6
II- 10	Pecks in a bushel	52.1	----	43.8	71.4	50.0	----	60.5	57.4	69.4	64.6
II- 11	Wheat yield per acre	12.5	----	0.0	0.0	0.0	----	6.7	0.0	.7	.7
II- 12	Cotton yield per acre	4.2	----	0.0	0.0	25.0	----	3.4	3.3	2.0	2.9
III- 1	Height of dining-room table	8.3	----	6.3	14.3	16.7	----	13.4	6.6	6.7	6.4
III- 2	Height of living-room ceiling	18.8	----	68.8	14.3	58.3	----	32.8	42.6	39.0	34.5
III- 3	Width between rails of railroad	16.7	----	37.5	14.3	0.0	----	15.9	29.5	17.8	15.8
III- 4	Glove size of average man	33.3	----	12.5	28.6	25.0	----	30.2	21.3	32.6	27.3
III- 5	Width of full size bed	2.1	----	18.8	0.0	8.3	----	1.7	8.2	6.2	5.0

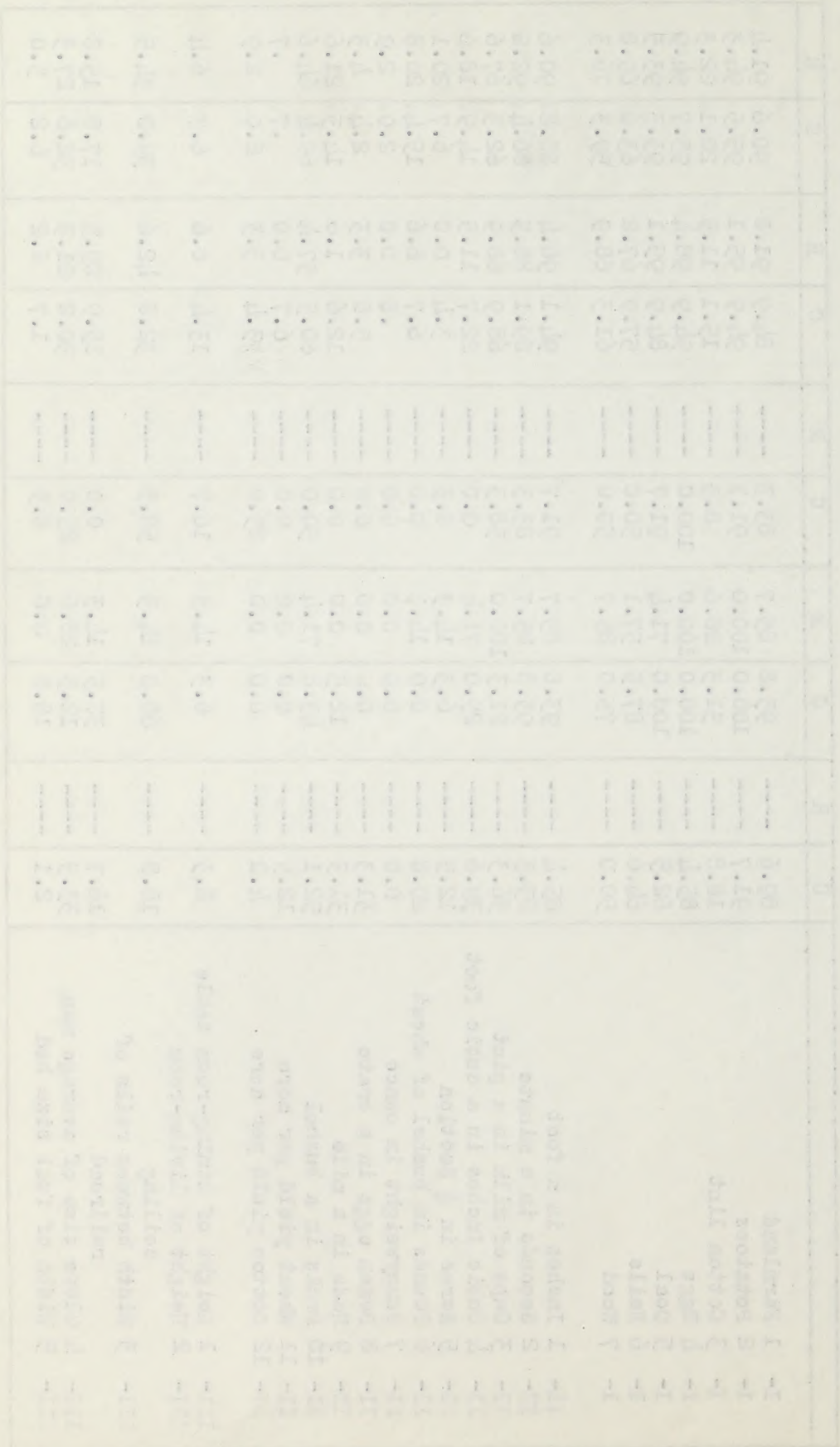

Table III Cont.

Item	Minnesota		Mississippi		Missouri		Montana		Nebraska	
	C	R	C	R	C	R	C	R	C	R
I- 1 Farmland	92.7	90.6	100.0	----	83.3	90.0	91.2	100.0	93.9	98.5
I- 2 Potatoes	93.9	100.0	83.3	----	95.8	94.0	97.1	77.8	96.9	98.5
I- 3 Cotton lint	36.6	50.0	0.0	----	27.1	32.0	14.7	55.6	6.1	14.7
I- 4 Eggs	97.6	96.9	100.0	----	97.9	96.0	100.0	100.0	96.9	94.1
I- 5 Coal	95.1	81.2	100.0	----	95.8	82.0	91.2	88.9	87.8	92.6
I- 6 Nails	71.9	93.8	100.0	----	62.5	80.0	52.9	88.9	51.2	58.8
I- 7 Wood	71.9	78.1	83.3	----	31.3	68.0	52.9	77.8	21.2	39.7
II- 1 Inches in a foot	97.6	93.8	100.0	----	93.8	94.0	91.2	77.8	78.8	92.7
II- 2 Seconds in a minute	96.3	93.8	100.0	----	89.6	94.0	88.2	77.8	96.9	88.2
II- 3 Cups of milk in a pint	81.7	78.1	100.0	----	66.7	68.0	76.5	77.8	72.7	77.9
II- 4 Cubic Inches in a cubic foot	17.1	15.6	0.0	----	25.0	24.0	8.8	11.1	57.6	7.4
II- 5 Acres in ¼ Section	8.5	21.9	100.0	----	2.1	22.0	2.9	0.0	27.3	7.4
II- 6 Pounds in bushel of wheat	14.6	28.1	50.0	----	8.3	26.0	2.9	11.1	30.3	16.2
II- 7 Pennyweight in ounce	1.2	3.1	66.7	----	0.0	10.0	0.0	11.1	0.0	4.4
II- 8 Dozen eggs in a crate	6.1	12.5	0.0	----	4.2	12.0	5.9	0.0	0.0	1.5
II- 9 Rods in a mile	26.8	18.8	66.7	----	8.3	22.0	2.9	0.0	45.5	11.8
II- 10 Pecks in a bushel	79.3	78.1	100.0	----	52.1	72.0	29.4	11.1	54.6	66.2
II- 11 Wheat yield per acre	3.7	6.3	16.7	----	0.0	4.0	0.0	0.0	0.0	0.0
II- 12 Cotton yield per acre	24.4	18.8	0.0	----	20.8	16.0	8.8	11.1	6.1	20.6
III- 1 Height of dining-room table	8.5	6.3	50.0	----	2.1	16.0	5.9	11.1	9.1	8.8
III- 2 Height of living-room ceiling	51.2	40.6	83.3	----	37.5	50.0	23.5	55.6	36.4	41.2
III- 3 Width between rails of railroad	26.8	34.4	83.3	----	25.0	36.0	2.9	44.4	12.1	17.7
III- 4 Glove size of average man	39.0	21.9	50.0	----	27.1	22.0	38.2	11.1	12.1	32.4
III- 5 Width of full size bed	0.0	3.1	0.0	----	2.1	6.0	2.9	0.0	3.0	8.8

Table III Cont.

Item	New Hampshire		New Mexico		New York		North Carolina		North Dakota	
	C	R	C	R	C	R	C	R	C	R
I- 1 Farmland	----	80.0	96.4	100.0	92.6	100.0	79.6	100.0	----	100.0
I- 2 Potatoes	----	100.0	100.0	100.0	97.5	100.0	94.4	100.0	-----	90.9
I- 3 Cotton lint	----	20.0	64.3	64.7	24.8	15.0	42.6	18.2	----	27.3
I- 4 Eggs	----	100.0	100.0	100.0	98.4	95.0	94.4	100.0	----	100.0
I- 5 Coal	----	100.0	82.1	88.2	94.2	95.0	83.3	100.0	----	100.0
I- 6 Nails	----	90.0	85.7	97.1	46.3	60.0	66.7	63.6	----	81.8
I- 7 Wood	----	70.0	57.1	46.1	47.9	55.0	75.9	63.6	----	72.7
II- 1 Inches in a foot	----	100.0	78.6	97.1	96.7	95.0	85.2	81.8	----	18.2
II- 2 Seconds in a minute	----	100.0	96.4	94.1	95.0	95.0	88.9	100.0	----	90.9
II- 3 Cups of milk in a pint	----	80.0	53.6	91.2	73.5	50.0	59.3	100.0	----	90.9
II- 4 Cubic Inches in a cubic foot	----	20.0	25.0	38.2	28.1	15.0	12.9	9.1	----	72.7
II- 5 Acres in $\frac{1}{4}$ Section	----	0.0	17.9	20.6	4.1	0.0	5.6	27.3	----	9.1
II- 6 Pounds in bushel of wheat	----	10.0	14.3	44.1	3.3	20.0	25.9	45.5	----	0.0
II- 7 Pennyweight in ounce	----	0.0	7.1	17.7	7.4	5.0	11.1	0.0	----	0.0
II- 8 Dozen eggs in a crate	----	0.0	7.1	23.5	0.0	10.0	1.9	0.0	----	0.0
II- 9 Rods in a mile	----	20.0	3.6	41.2	18.2	15.0	22.2	36.4	----	9.1
II- 10 Pecks in a bushel	----	80.0	75.0	67.7	64.4	85.0	61.1	72.7	----	63.6
II- 11 Wheat yield per acre	----	0.0	0.0	0.0	1.7	5.0	7.4	0.0	----	9.1
II- 12 Cotton yield per acre	----	0.0	32.1	14.7	6.6	15.0	7.4	9.1	----	36.4
III- 1 Height of dining-room table	----	10.0	7.1	8.8	8.3	10.0	5.6	18.2	----	9.1
III- 2 Height of living-room ceiling	----	50.0	57.1	55.9	41.3	45.0	18.5	45.5	----	36.4
III- 3 Width between rails of railroad	----	30.0	35.7	23.5	18.2	25.0	7.4	0.0	----	9.1
III- 4 Glove size of average man	----	30.0	46.4	47.1	39.7	40.0	27.8	18.2	----	0.0
III- 5 Width of full size bed	----	10.0	7.1	2.9	4.9	5.0	1.9	0.0	----	0.0

Table III Cont.

	Ohio		Oklahoma		Oregon		Pennsylvania		Rhode Island	
	C	R	C	R	C	R	C	R	C	R
I- 1 Farmland	95.1	91.2	92.4	100.0	95.5	92.3	90.5	90.0	72.2	----
I- 2 Potatoes	83.6	94.6	95.2	100.0	96.8	93.9	92.9	100.0	100.0	----
I- 3 Cotton lint	22.9	27.7	28.6	40.0	26.7	28.5	21.9	15.0	16.7	----
I- 4 Eggs	90.2	95.2	97.1	100.0	96.8	93.9	97.0	95.0	100.0	----
I- 5 Coal	93.1	91.5	75.2	88.9	65.6	76.9	90.5	85.0	83.3	----
I- 6 Nails	54.1	71.5	71.4	66.7	67.2	79.2	62.7	75.0	44.4	----
I- 7 Wood	40.9	43.0	58.1	84.4	85.9	86.9	36.7	55.0	44.4	----
II- 1 Inches in a foot	80.3	87.8	94.1	97.8	92.7	93.9	92.3	100.0	100.0	----
II- 2 Seconds in a minute	88.5	69.5	83.8	88.9	84.6	92.3	87.6	90.0	88.9	----
II- 3 Cups of milk in a pint	65.6	54.6	71.4	51.1	66.8	69.2	69.8	80.0	66.7	----
II- 4 Cubic Inches in a cubic foot	26.2	5.8	13.3	11.1	11.7	16.9	26.0	15.0	5.6	----
II- 5 Acres in $\frac{1}{4}$ Section	19.7	.8	8.6	20.0	2.8	12.3	10.1	5.0	0.0	----
II- 6 Pounds in bushel of wheat	11.5	14.2	15.2	33.3	6.5	18.5	8.9	15.0	5.6	----
II- 7 Pennyweight in ounce	0.0	2.7	2.9	0.0	2.8	7.7	.6	0.0	0.0	----
II- 8 Dozen eggs in a crate	3.3	9.2	3.8	33.3	7.7	6.9	1.2	5.0	0.0	----
II- 9 Rods in a mile	18.0	15.2	14.3	13.3	2.8	6.9	17.2	10.0	5.6	----
II- 10 Pecks in a bushel	44.3	40.7	60.9	68.9	36.4	43.1	63.3	65.0	61.1	----
II- 11 Wheat yield per acre	1.6	3.0	4.8	15.6	1.6	0.0	.6	0.0	0.0	----
II- 12 Cotton yield per acre	14.8	17.9	4.8	11.1	3.2	.7	5.9	5.0	5.6	----
III- 1 Height of dining-room table	3.3	5.1	3.8	8.9	10.5	9.2	11.2	10.0	11.1	----
III- 2 Height of living-room ceiling	45.9	32.9	45.7	37.8	41.8	38.5	31.4	35.0	61.1	----
III- 3 Width between rails of railroad	21.3	10.2	20.9	24.4	17.8	24.6	13.6	15.0	16.7	----
III- 4 Glove size of average man	72.1	35.6	33.3	42.2	27.9	28.5	34.9	50.0	22.2	----
III- 5 Width of full size bed	1.6	3.0	2.9	4.4	7.3	3.9	2.9	0.0	11.1	----

Table III Cont.

	South Carolina		South Dakota		Tennessee		Texas		Virginia	
	C	R	C	R	C	R	C	R	C	R
I- 1 Farmland	100.0	----	88.0	83.3	90.7	93.8	87.1	93.3	84.1	93.5
I- 2 Potatoes	100.0	----	96.0	100.0	91.9	96.9	94.7	97.5	90.9	98.7
I- 3 Cotton lint	0.0	----	20.0	66.7	32.6	40.6	25.0	31.1	16.7	27.3
I- 4 Eggs	100.0	----	100.0	100.0	94.2	98.4	94.7	99.2	97.7	100.0
I- 5 Coal	100.0	----	96.0	100.0	93.0	90.6	80.3	85.7	86.4	90.9
I- 6 Nails	50.0	----	64.0	50.0	79.1	89.1	75.0	79.8	68.2	90.9
I- 7 Wood	0.0	----	20.0	50.0	68.6	68.8	67.4	73.1	61.4	83.1
II- 1 Inches in a foot	75.0	----	92.0	100.0	93.0	95.3	91.6	97.5	88.6	100.0
II- 2 Seconds in a minute	75.0	----	88.0	100.0	93.0	89.1	84.9	95.8	81.8	96.1
II- 3 Cups of milk in a pint	100.0	----	68.0	83.3	59.3	70.3	64.4	67.2	68.2	74.0
II- 4 Cubic Inches in a cubic foot	25.0	----	0.0	16.7	15.1	6.3	18.2	13.5	25.0	23.4
II- 5 Acres in $\frac{1}{4}$ Section	0.0	----	4.0	16.7	6.9	23.4	9.1	6.7	2.3	0.0
II- 6 Pounds in bushel of wheat	0.0	----	4.0	16.7	17.4	34.4	19.7	15.1	13.6	27.3
II- 7 Pennyweight in ounce	0.0	----	0.0	16.7	1.2	14.1	3.8	2.5	0.0	1.3
II- 8 Dozen eggs in a crate	0.0	----	4.0	0.0	0.0	7.8	2.9	6.7	9.1	23.4
II- 9 Rods in a mile	25.0	----	16.0	16.7	16.3	14.1	15.2	21.0	36.4	19.5
II- 10 Pecks in a bushel	50.0	----	68.0	66.7	77.9	70.3	56.8	63.0	68.2	72.7
II- 11 Wheat yield per acre	25.0	----	0.0	0.0	15.1	20.3	17.4	20.1	0.0	11.7
II- 12 Cotton yield per acre	0.0	----	24.0	16.7	17.4	15.6	12.9	11.8	4.6	11.7
III- 1 Height of dining-room table	0.0	----	12.0	16.7	5.8	12.5	4.6	7.6	0.0	19.5
III- 2 Height of living-room ceiling	0.0	----	60.0	33.3	39.5	26.6	33.3	33.6	31.8	36.4
III- 3 Width between rails of railroad	50.0	----	12.0	0.0	23.3	17.2	14.4	13.5	13.6	23.4
III- 4 Glove size of average man	50.0	----	24.0	33.3	41.9	31.3	34.1	21.0	27.3	50.7
III- 5 Width of full size bed	0.0	----	12.0	0.0	8.1	4.7	5.3	5.0	4.6	14.3

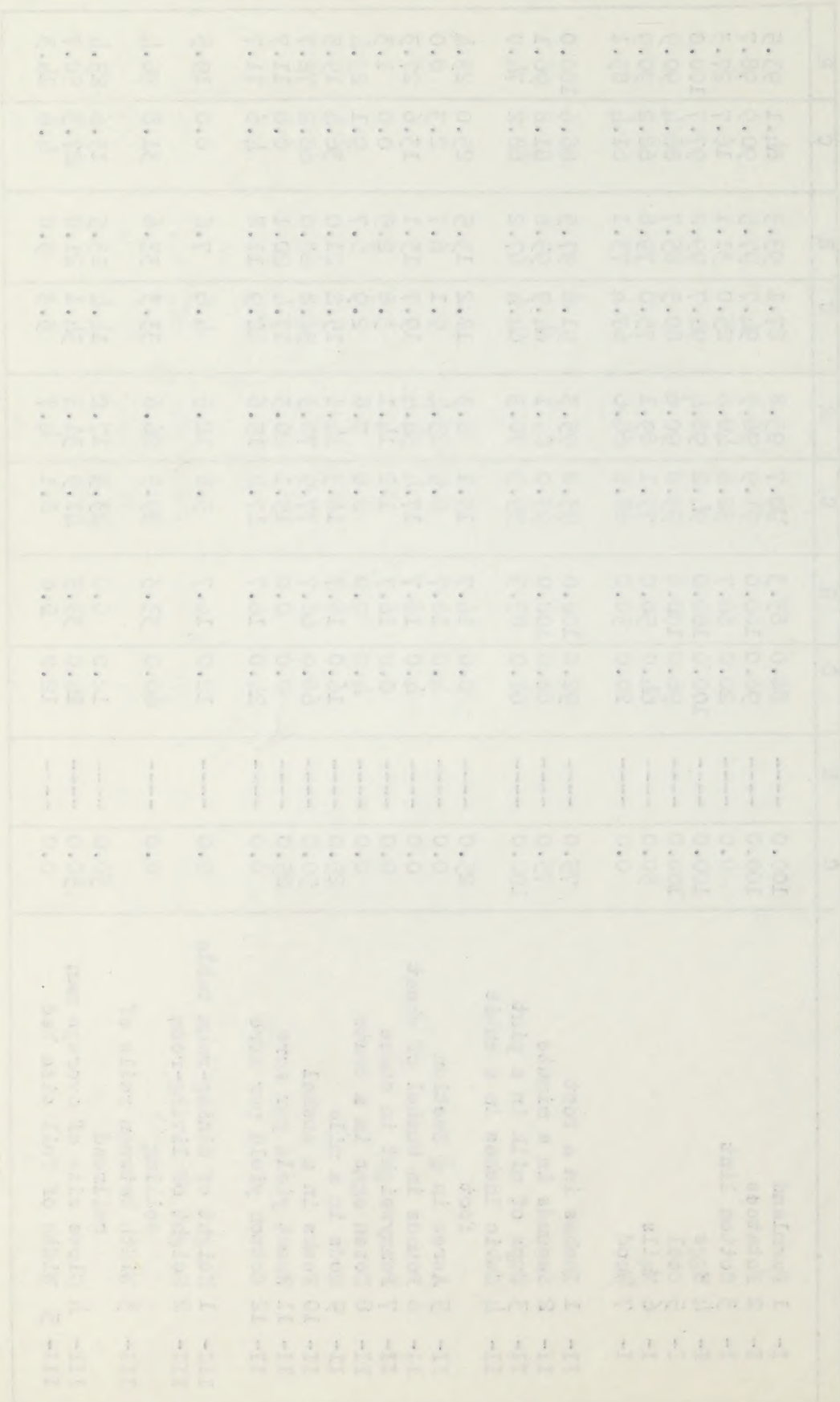

Table III Cont.

	Washington		West Virginia		Wisconsin		Wyoming	
	C	R	C	R	C	R	C	R
I- 1 Farmland	92.5	92.5	100.0	----	93.2	86.4	100.0	100.0
I- 2 Potatoes	96.6	92.5	100.0	----	94.9	94.0	100.0	100.0
I- 3 Cotton lint	32.2	46.2	45.5	----	16.9	29.5	33.3	46.2
I- 4 Eggs	97.7	92.5	100.0	----	93.2	89.8	100.0	92.3
I- 5 Coal	86.0	90.5	90.9	----	83.1	78.8	100.0	100.0
I- 6 Nails	83.9	78.3	75.8	----	50.9	71.2	66.7	84.6
I- 7 Wood	89.1	88.7	60.6	----	33.9	65.5	8.3	30.8
II- 1 Inches in a foot	91.9	97.1	93.9	----	89.8	89.8	100.0	100.0
II- 2 Seconds in a minute	89.1	93.4	93.9	----	88.1	84.8	91.7	92.3
II- 3 Cups of milk in a pint	74.1	69.8	75.8	----	61.0	66.9	58.3	46.2
II- 4 Cubic Inches in a cubic foot	13.8	9.4	12.1	----	11.9	5.1	0.0	30.8
II- 5 Acres in $\frac{1}{4}$ Section	3.5	.9	9.1	----	1.7	5.1	25.0	7.7
II- 6 Pounds in bushel of wheat	5.2	.9	12.1	----	0.0	11.0	8.3	0.0
II- 7 Pennyweight in ounce	2.3	0.0	3.1	----	1.7	0.0	0.0	0.0
II- 8 Dozen eggs in a crate	2.8	6.6	27.3	----	1.7	3.4	8.3	7.7
II- 9 Rods in a mile	9.2	16.0	6.1	----	15.3	3.4	25.0	7.7
II- 10 Pecks in a bushel	31.6	50.0	60.6	----	50.9	55.9	58.3	30.8
II- 11 Wheat yield per acre	2.3	5.7	0.0	----	0.0	0.0	0.0	0.0
II- 12 Cotton yield per acre	19.5	9.4	6.1	----	13.6	7.6	8.3	7.7
III- 1 Height of dining-room table	9.2	9.4	9.1	----	8.5	5.9	8.3	23.1
III- 2 Height of living-room ceiling	54.6	45.3	27.3	----	30.5	27.1	41.7	46.2
III- 3 Width between rails of railroad	17.8	17.9	18.2	----	15.3	22.0	8.3	15.4
III- 4 Glove size of average man	41.9	33.9	63.6	----	25.4	16.9	41.7	15.4
III- 5 Width of full size bed	9.8	5.7	6.1	----	3.4	2.5	16.7	0.0

these percentages if found in columns three and five with the probable error of the differences (P.E. Diff.) of the percentages in Column seven. Of the 24 items only six of them show any significant difference between city and rural. With the exception of II-2, seconds in a minute, these are in favor of the rural. Even though the difference is statistically significant, it is not a large one. These particular items are noted as each section is treated separately.

Section I

A glance at items I-1, farmland, I-2, potatoes, and I-4, eggs, indicates that these pupils are well acquainted with the way in which those commodities are sold. The high percentage of correct responses for farmland is a bit surprising, especially with so little difference between city and rural. Items I-5, coal, and I-6, nails, also show that these children have a fairly good knowledge of the way in which these commodities are sold. There is no significant difference between the city and rural as shown by the percentage difference of 2.5 ± P.E. .63 for I-5, coal, and 3.0 ± P.E. .80 for I-6, nails as shown in Table IV.

That children have little conception of the way in which cotton lint is sold is shown by the low percentage it carries. Here there is a statistical significant percentage difference of 4.2 ± P.E. .61 in favor of the rural. The Wilson[1] study shows that even adults in the cotton belt (Louisiana) do not score well in this item. Figure 1 shows graphically for each state, city and rural, the correct responses on

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1. Wilson, D., op, cit. p. 52

Table IV Shows the Percentage of Correct Answers for the 43 States and the District of Columbia, City and Rural, with the Probable Error for Each and the Probable Error of the Percentage Difference

		City		Rural			
		4246	P. E. of Percent	2327	P. E. of Percent	Percentage Difference	P. E. of Percentage Difference
I- 1	Farmland	90.9	± .29	92.8	± .35	1.9	± .45
I- 2	Potatoes	94.8	± .23	93.8	± .34	1.0	± .41
I- 3	Cotton lint	26.1	± .45	30.3	± .64	4.2	± .61
I- 4	Eggs	96.3	± .19	93.1	± .35	3.2	± .39
I- 5	Coal	86.4	± .39	88.9	± .49	2.5	± .63
I- 6	Nails	67.6	± .48	70.6	± .64	3.0	± .80
I- 7	Wood	58.8	± .51	65.5	± .66	6.7	± .83
II- 1	Inches in foot	91.3	± .29	90.1	± .42	1.2	± .51
II- 2	Seconds in a minute	88.7	± .33	82.8	± .53	5.9	± .62
II- 3	Cups of milk in a pint	70.1	± .47	71.2	± .63	1.1	± .79
II- 4	Cubic Inches in cubic foot	16.9	± .39	15.4	± .50	1.5	± .63
II- 5	Acres in ¼ Section	7.8	± .28	9.2	± .40	1.4	± .49
II- 6	Pounds in bushel of wheat	10.9	± .16	15.4	± .50	4.5	± .53
II- 7	Pennyweight in an ounce	3.3	± .18	4.5	± .29	1.2	± .34
II- 8	Dozen eggs in a crate	4.6	± .22	8.9	± .39	4.3	± .45
II- 9	Rods in a mile	13.7	± .35	15.3	± .50	1.6	± .61
II- 10	Pecks in a bushel	58.1	± .51	58.7	± .69	.6	± .86
II- 11	Wheat yield per acre	4.2	± .21	5.6	± .32	1.2	± .38
II- 12	Cotton yield per acre	9.9	± .31	12.0	± .45	2.1	± .55
III- 1	Height of dining-room table	8.3	± .29	8.7	± .39	.4	± .49
III- 2	Height of living-room ceiling	38.4	± .50	37.3	± .67	1.1	± .84
III- 3	Width between rails of railroad	18.7	± .40	20.7	± .57	2.0	± .69
III- 4	Glove size of average man	32.2	± .48	32.1	± .65	.1	± .80
III- 5	Width of full size bed	5.7	± .24	5.3	± .31	.4	± .39

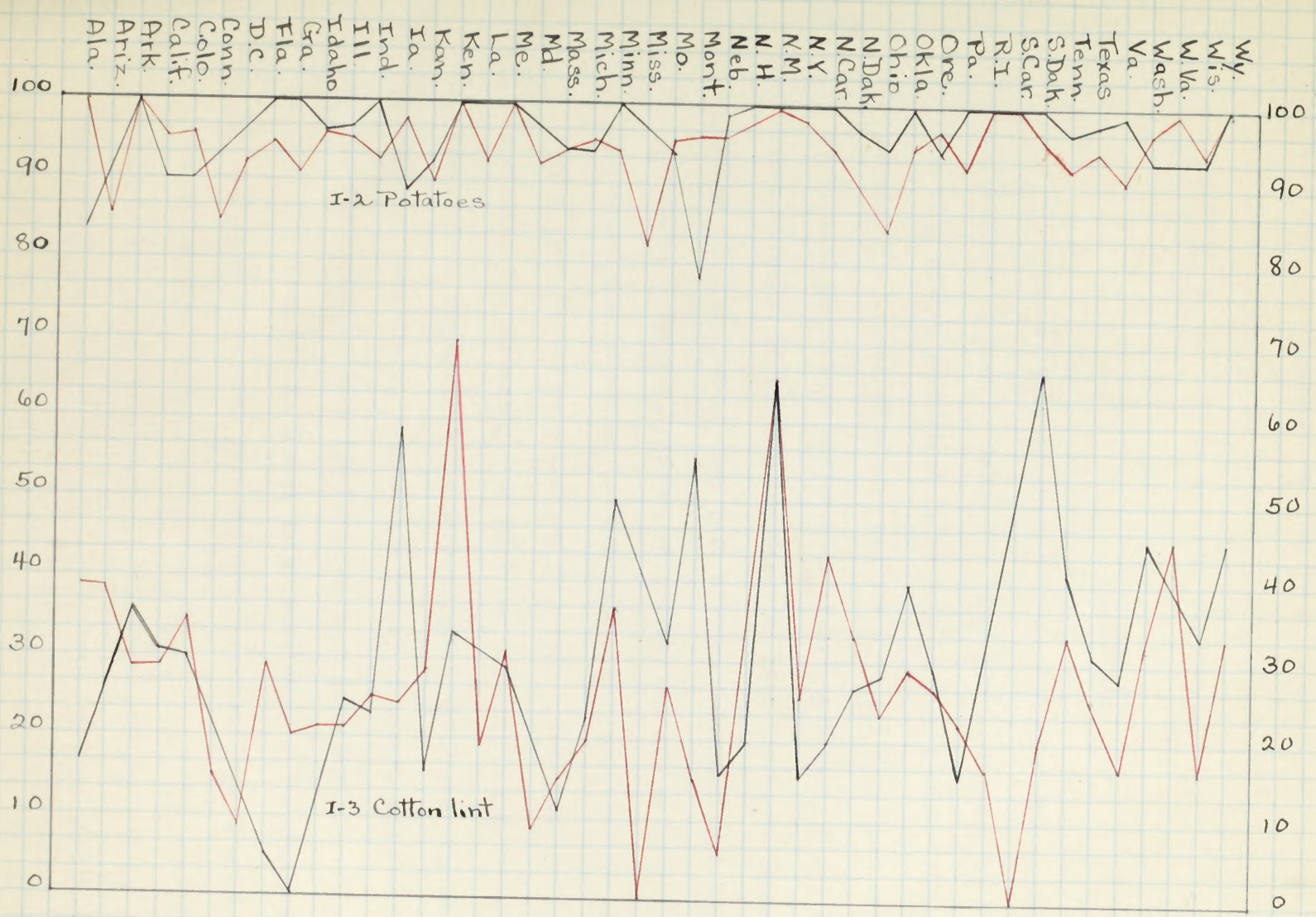

Fig. 1 Showing Graphically the Percentage of Correct Answers on Sections I-2, Potatoes, and I-3, Cotton lint, City and Rural, for the 43 States and District of Columbia

— City — Rural

this item in comparison to item I- 2, potatoes, where the percentages are high. For item I- 7, wood, there is a small significant difference of 6.7 ± P. E. .83 in favor of the rural.

Section II

Three items of Section II show statistical significant differences as seen in Table IV. Item II- 2, seconds in a minute, favors the city with a percentage difference of 5.9 ± P.E. .62. Items II- 6, pounds in a bushel of wheat, and II- 8, dozen eggs in a crate, favor the rural with percentage differences of 4.5 ± P.E. .53 and 4.3 ± P.E. .45 respectively. Of the 405 responses on item II- 8, as shown in Table II, 205 or slightly better than half of them indicated that either their parents were farmers, grocers or poultry raisers or they themselves had had experience in one of these occupations. Thus experience seems to play a part in the responses on this item. For item II- 2, seconds in a minute, the percentages of 88.7 for the city and 82.8 for the rural are high as compared to the percentages of 10.9 for city and 15.4 for rural on item II- 6, pounds in a bushel of wheat, and 4.6 for city and 8.9 for rural for item II- 8, dozen eggs in a crate.

Item II- 1, inches in a foot, carries the highest percentage of any item of Section II. For city and rural they are 91.3 ± P.E. .29 and 90.1 ± P.E. .42 respectively. Items II- 3, cups of milk in a pint, and II- 10, pecks in a bushel, carry fairly high percentages. For city and rural they are 70.1 ± P.E. .47 and 71.2 ± P.E. .63 for item II- 3 and 58.1 ± P.E. .51 and 58.7 ± P.E. .69 for item II- 10. All of these items appear in the arithmetic text-books and are also among the more commonly used measures. The remaining items all carry low percentages for

correct responses.

Items II- 11, good average yield of cotton per acre, and II- 12, good average yield of wheat per acre, are ones which would be expected to show differences throughout various parts of the country. Figures 2 and 3 show the distribution of the percentages on these for the 43 states and the District of Columbia. Figure 2 shows that the states of Alabama, Arkansas, Georgia, Louisiana, Mississippi, South Carolina, Tennessee and Texas have by far the highest percentage of correct responses on item II- 11, average yield of cotton per acre. These states lie within the cotton belt. Experience is doubtless the contributing factor. On item II- 12, average yield of wheat per acre, the states of Arkansas, Colorado, Idaho, Kansas, Kentucky, Maryland, Minnesota, Missouri, New Mexico, North Dakota and Washington carry the highest percentage of correct responses. These may be accounted for on the basis that many of these states lie within the wheat belt. Those which do not are states in which considerable wheat is grown.

Section III

Items III- 1, height of a dining-room table, and III- 5, width of a full size bed, carry very low percentages for both city and rural as shown in Table IV. The two items carrying the highest percentages of this section are III- 2, height of a living-room ceiling, and III- 4, glove size of an average man. The percentages for the former for city and rural respectively are 38.4 ± P.E. .50 and 37.3 ± P.E. .67 while those for the latter are 32.2 ± P.E. .48 and 32.1 ± P.E. .65. Item III- 3, width between rails of a railroad, also has a fairly low percentage for

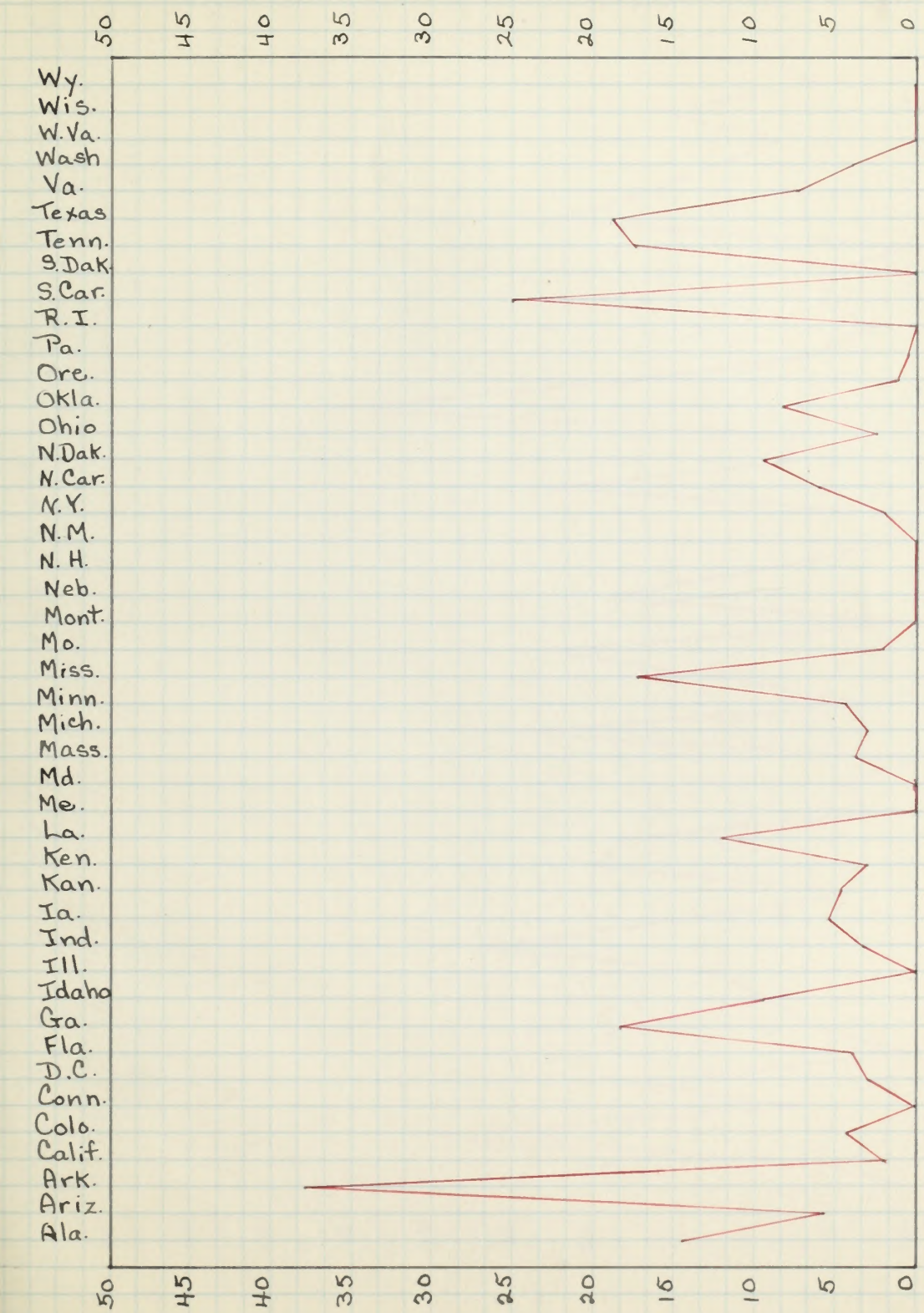

Fig. 2 Showing Graphically the Percentage of Correct Answers on Section II–11, Cotton Yield, City and Rural Combined, for the 43 States and District of Columbia

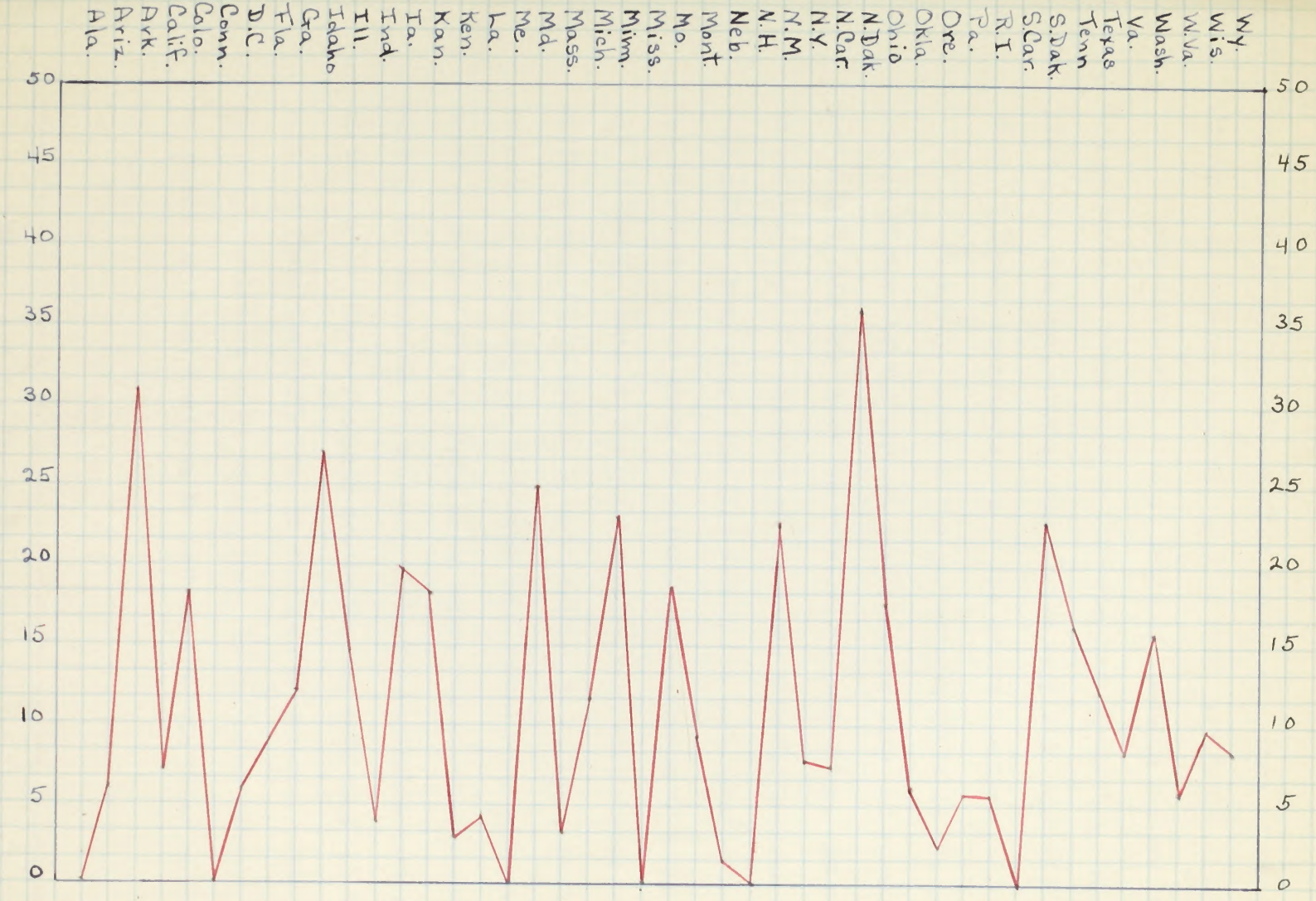

Fig. 3 Showing Graphically the Percentage of Correct Answers on Section II-12, Wheat Yield, City and Rural Combined, for the 43 States and District of Columbia

each of 18.7 ± P.E. .40 and 20.7 ± P.E. .57. None of the percentage differences between city and rural of this section are significant. This is very obvious as seen in Table IV, columns six and seven. These low percentages would seem to indicate that the ability to estimate distances, heights, widths, etc. is not very well established with these children, representative of the entire country.

Figure 4, based on the percentages of Table IV, gives a graphic picture of the cerrect responses for city and rural. It shows how closely the two lines run parallel to each other. At a glance it is obvious that the majority of the items show differences which are negligible. Even where the differences are more noticeable they are not extremely so as shown in columns six and seven of Table IV. Only six of the 24 items of the questionnaire show statistical significant differences. These are I- 3, cotton lint, I- 4, eggs, I- 7, wood, II- 2, seconds in a minute, II- 6, pounds in a bushel of wheat, and II- 8, dozen eggs in a crate. Items I- 4, eggs, and II- 2, seconds in a minute, are favorable to the city while the remaining ones are favorable to the rural. These findings are in keeping with those of Wise[1] in which he found the difference in the type of problems secured from rural and city localities to be negligible. On the other hand it is reasonable to expect the rural children to do better on the items on which they do excel.

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1. Wise, Carl T., "Arithmetic Problems Arising in Various Occupations", Elementary School Journal, 20: 118- 136, October, 1919.

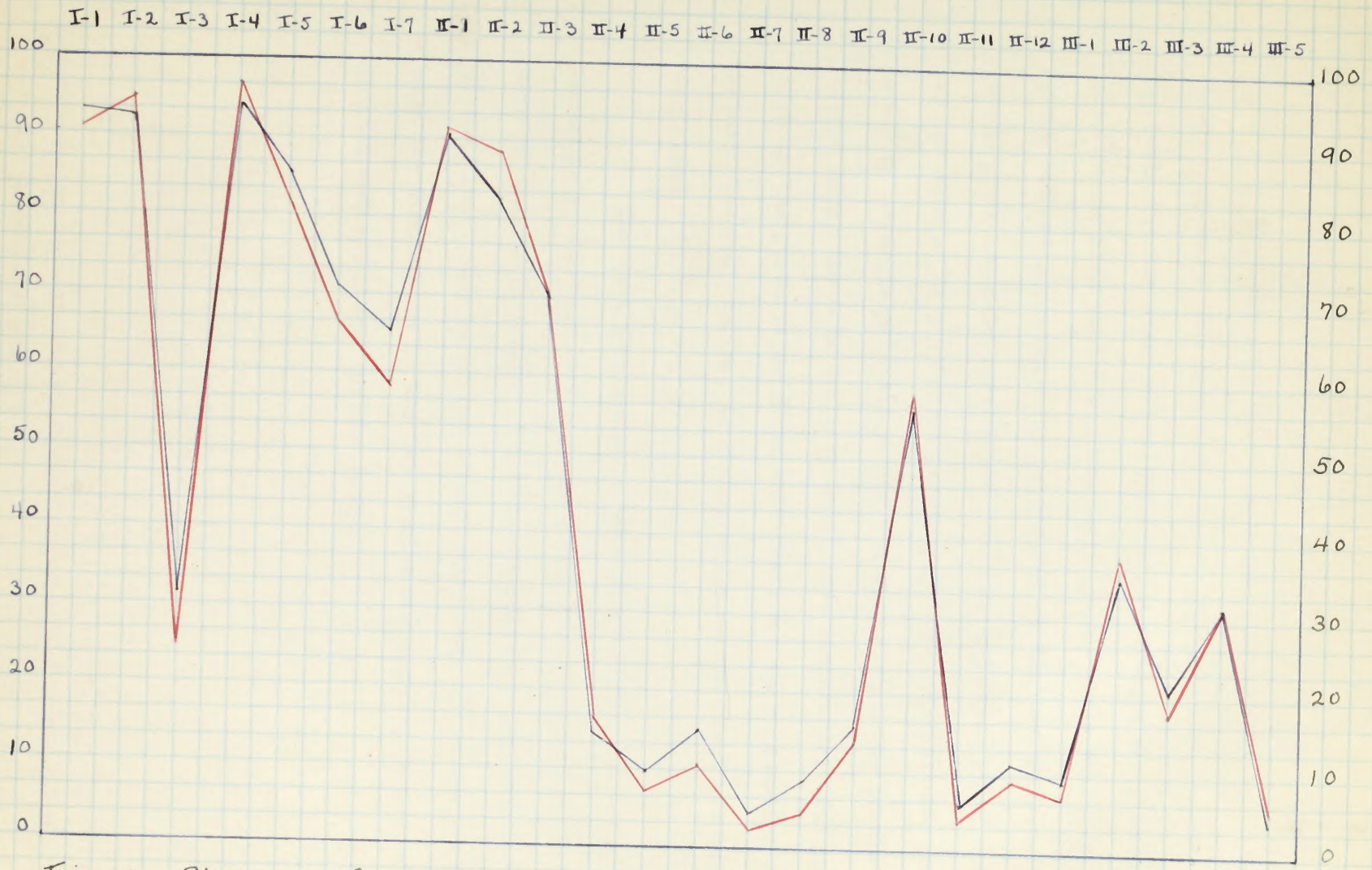

Fig. 4 Showing Graphically the Percentage of Correct Answers on Sections I, II, III, City and Rural, for the 43 States and District of Columbia

— City — Rural

It is of interest to note how the findings on items in this study compare to the same items in the Wilson study.[1] These are shown in Table V. Her study gives separate percentages for grades three to six, Junior High School and the tenth grade, while the present study gives but one percentage for grades two to ten inclusive. The present study gives separate percentages for city and rural which are not given in her study. If a combined percentage were available for the first study or separate percentages for the different grade levels in the second study the data would be still more comparable. But mere inspection of the percentages shows that there are no outstanding differences between the two studies, as the percentages run about the same for each item.

The fact that certain items in the first study bear low percentages and certain ones high or fairly high percentages is consistently true of the second study. That the second study confirms the findings of the first study is a very significant fact. It therefore tends to make the combination of the two studies the more valid and reliable as pointed out by Peters[2] in his study.

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1. Wilson, D. Op. Cit. p. 87

2. Peters, op. cit. pp. 3-10.

Table V Shows, on a Percentage Basis, a Comparison of the Items Common to the Present Study and the Wilson Study.

		Present Study			Wilson Study		
		Grades 2 - 10			Grades 3-6	J.H.S.	Grade 10
		City	Rural	Total			
I- 1	Farmland	90.9	92.8	91.6	76.2	89.6	96.9
I- 2	Potatoes	94.8	93.8	94.5	94.9	99.2	98.8
I- 3	Cotton lint	26.1	30.3	27.5	9.2	16.5	29.3
I- 4	Eggs	96.3	93.1	95.2	90.6	97.7	99.4
I- 5	Nails	67.6	70.6	68.5	41.0	61.2	70.7
I- 7	Wood	58.8	65.5	61.2	24.6	53.5	80.5
II- 1	Inches in a foot	91.3	90.1	90.8	86.5	98.8	100.0
II- 4	Cubic inches in a cubic foot	16.9	15.4	16.4	7.9	21.6	12.8
II- 5	Acres in a quarter section	7.8	9.2	8.2	.9	3.2	2.4
II- 6	Pounds in a bushel of wheat	10.9	15.4	12.5	.3	5.6	9.7
II- 7	Pennyweight in an ounce	3.3	4.5	3.7	1.6	4.3	1.2
II- 8	Dozen eggs in a crate	4.6	8.9	6.1	.8	1.9	3.0
III- 1	Height of dining-room table	8.3	8.7	8.3	8.6	9.7	10.4
III- 2	Height of living-room ceiling	38.4	37.3	38.1	32.2	45.7	51.2
III- 3	Width between rails of railroad	18.7	20.7	19.4	6.8	13.6	15.9
III- 5	Width of full size bed	5.7	5.3	5.6	4.9	5.9	7.3

CHAPTER VI

Sectional Distribution on Basis of "N", "1", "2" and "3"

The purpose of this chapter is to show the distribution of the correct responses on the basis of "N", "1", "2", and "3". "N" indicates that the answer was a correct one but no number appeared opposite it. The number "1" indicates that the information was learned in school, the number "2" that it was learned from experience, while the number "3" indicates a mere guess.

In view of the voluminous amount of data it seemed impracticable and unnecessary to tabulate each of the states on this basis, and so selections were made from among the states. In making these selections, care was taken to include those from representative sections of the country in order to secure a variety of information on the various commodities if such existed. Each of the states chosen, Massachusetts, Minnesota, Ohio, Texas and Washington, carry a large number of returns, with a total of 565 for the city and 613 for the rural. This yields a total of 567 for the boys and 611 for the girls.

Table VI shows the percentage of correct responses for the 5 states for each of Sections I, II and III distributed on the basis of "N", "1", "2", and "3". Table VII shows the percentage differences for data taken from Table VI. The discussion which follows will be based on these two tables.

Note: The correct and accepted answers to Sections I, II and III are to be found in Appendix B.

Table VI Shows the Percentage of Correct Responses for Five Selected States, City and Rural, Distributed on the Basis of "N" (No Number), "1" (School), "2" (Experience), and "3" (Guess).

		City (565)					Rural (613)				
		N	1	2	3	Total Correct	N	1	2	3	Total Correct
I- 1	Farmland	.7	41.1	42.6	6.0	90.4	.3	24.5	59.7	7.3	91.8
I- 2	Potatoes	1.1	24.9	58.9	10.3	95.2	.8	19.7	68.8	5.7	95.1
I- 3	Cotton lint	.2	3.9	4.9	17.7	26.7	0.0	5.2	5.5	22.2	32.9
I- 4	Eggs	1.2	26.4	64.1	4.4	96.1	.3	20.6	72.9	2.1	95.9
I- 5	Coal	1.6	28.5	46.4	9.7	86.2	.9	23.3	54.1	11.6	90.0
I- 6	Nails	.9	10.1	33.1	27.8	71.9	1.6	7.8	45.7	20.4	75.5
I- 7	Wood	.7	11.2	46.2	12.9	71.0	.6	10.1	37.7	12.7	61.1
II- 1	Inches in a foot	1.8	75.0	13.8	1.8	92.4	.9	75.2	14.7	1.8	92.6
II- 2	Seconds in a Minute	1.1	62.8	23.9	1.9	89.7	1.1	53.0	25.4	2.3	81.8
II- 3	Cups of milk in a pint	1.9	25.8	23.0	20.5	71.2	.8	25.4	15.3	20.7	62.2
II- 4	Cubic Inches in a Cubic Foot	.4	14.1	1.4	2.6	18.5	.2	7.0	.6	.9	8.7
II- 5	Acres in Quarter section	0.0	3.2	1.4	2.6	7.2	0.0	1.5	.9	1.1	3.5
II- 6	Pounds in bushel of wheat	.4	2.5	1.2	6.9	11.0	.2	2.6	2.9	8.3	14.0
II- 7	Pennyweight in ounce	0.0	1.1	0.0	.9	2.0	0.0	.5	0.0	1.6	2.1
II- 8	Dozen eggs in crate	.2	.2	1.6	2.1	4.1	0.0	.8	4.9	2.3	8.0
II- 9	Rods in mile	.2	9.7	1.4	3.6	14.9	.8	10.8	1.3	2.4	15.3
II- 10	Pecks in bushel	1.4	35.4	7.4	8.1	52.3	.8	34.9	7.2	7.2	50.1
II- 11	Wheat yield per acre	0.0	.2	.7	6.2	7.1	0.0	.3	1.8	4.6	6.7
II- 12	Cotton yield per acre	0.0	.4	2.3	12.6	15.3	.2	.2	3.8	9.8	14.0
III- 1	Height of dining-room table	.2	0.0	.2	7.9	8.3	0.0	.2	.5	5.9	6.6
III- 2	Height of living-room ceiling	.4	.2	8.3	35.0	44.5	.5	1.1	8.5	26.4	36.5
III- 3	Width between rails of railroad	.2	.2	2.3	15.9	18.6	0.0	.3	1.6	13.4	15.3
III- 4	Glove size of average man	1.4	.4	4.1	35.2	41.1	.2	.8	3.9	25.4	30.3
III- 5	Width of full size bed	0.0	0.0	1.2	3.6	4.8	.2	0.0	.5	3.8	4.5

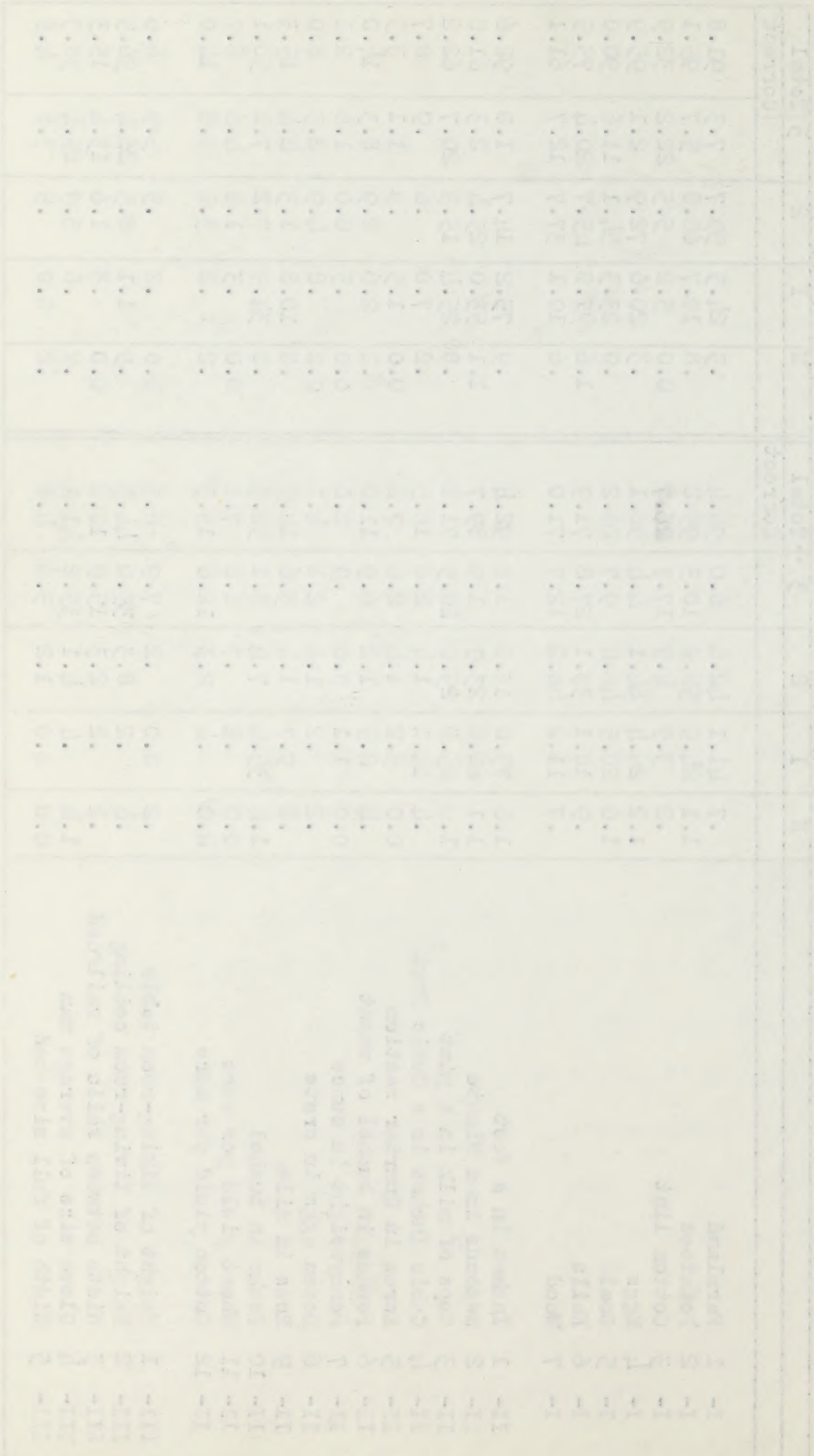
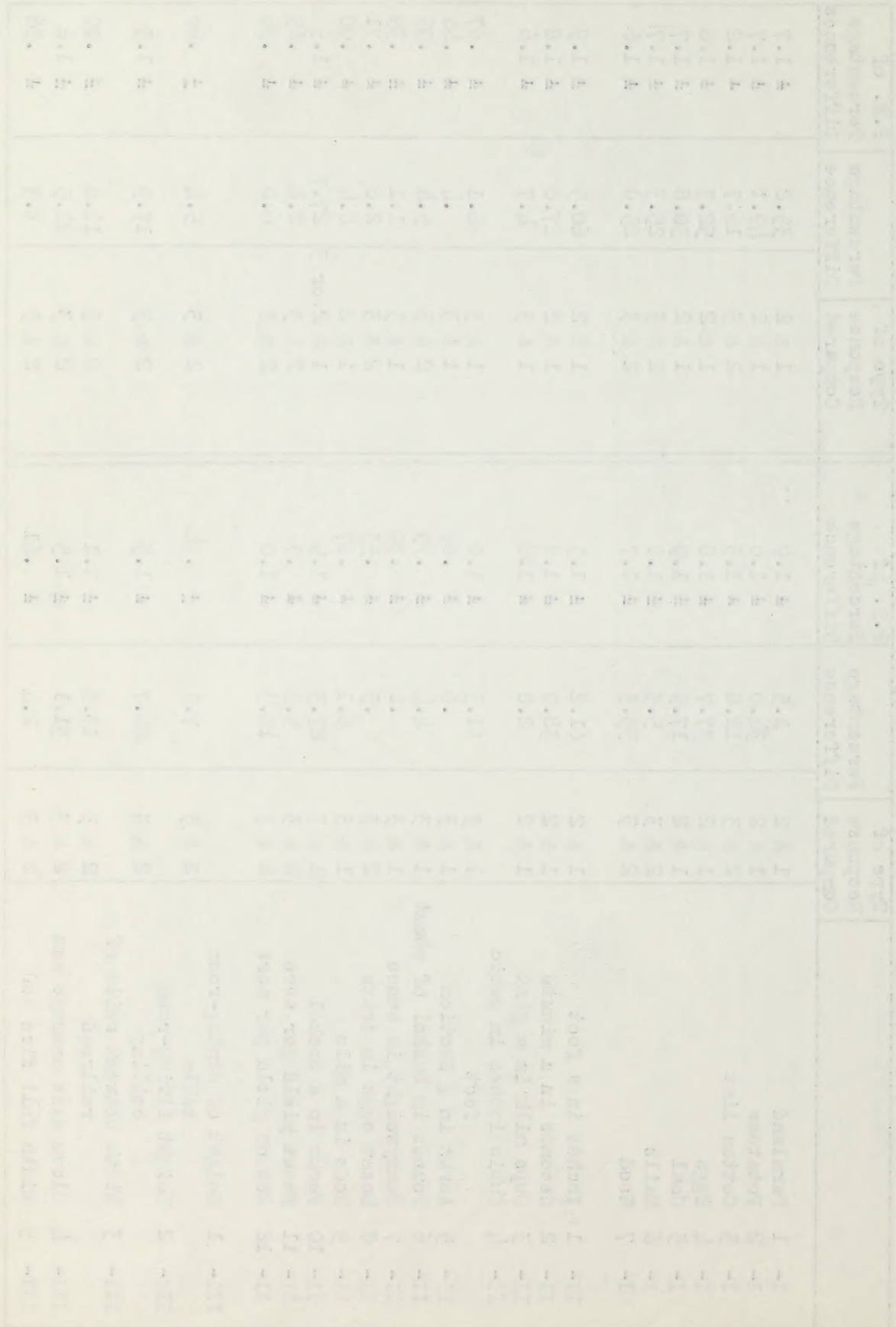


Table VII Shows the Percentage Differences for Each Item of Sections I, II, and III, with the Probable Error for Each, for Five Selected States, Based upon Table VI.

		City			Rural		
		Type of Response Compared	Percentage Difference	P.E. of Percentage Difference	Type of Response Compared	Percentage Difference	P.E. of Percentage Differences
I- 1	Farmland	1 & 2	1.5	± 1.9	1 & 2	35.2	± 1.7
I- 2	Potatoes	1 & 2	34.0	± 1.8	1 & 2	49.1	± 1.7
I- 3	Cotton lint	2 & 3	12.8	± 1.3	2 & 3	16.7	± 1.2
I- 4	Eggs	1 & 2	37.7	± 1.8	1 & 2	52.3	± 1.6
I- 5	Coal	1 & 2	17.9	± 1.9	1 & 2	30.8	± 1.7
I- 6	Nails	2 & 3	5.3	± 1.8	2 & 3	25.3	± 1.7
I- 7	Wood	2 & 3	33.3	± 1.7	2 & 3	25.0	± 1.6
II- 1	Inches in a foot	1 & 2	61.2	± 1.5	1 & 2	60.5	± 1.5
II- 2	Seconds in a minute	1 & 2	38.9	± 1.8	1 & 2	27.6	± 1.8
II- 3	Cups milk in a pint	1 & 2	2.8	± 1.6	1 & 3	4.7	± 1.6
II- 4	Cubic inches in cubic foot	1 & 3	11.5	± 1.0	1 & 3	6.1	± .67
II- 5	Acres in ½ Section	1 & 3	.6	± .66	1 & 3	.4	± .44
II- 6	Pounds in bushel of wheat	1 & 3	4.4	± .79	2 & 3	5.4	± .95
II- 7	Pennyweight in ounce	1 & 3	.2	± .39	1 & 3	1.1	± .39
II- 8	Dozen eggs in crate	2 & 3	.5	± .53	2 & 3	2.6	± .71
II- 9	Rods in a mile	1 & 3	6.1	± .87	1 & 2	8.4	± .90
II- 10	Pecks in a bushel	1 & 3	27.3	± 1.5	1 & 2 or 3	27.7	± 1.5
II- 11	Wheat yield per acre	2 & 3	5.5	± .7	2 & 3	2.8	± .65
II- 12	Cotton yield per acre	2 & 3	10.3	± 1.0	2 & 3	6.0	± .96
III- 1	Height of dining-room table	2 & 3	7.7	± .74	2 & 3	5.4	± .66
III- 2	Height living-room ceiling	2 & 3	26.7	± 1.5	2 & 3	17.9	± 1.3
III- 3	Width between rails of railroad	2 & 3	13.6	± 1.1	2 & 3	11.8	± .99
III- 4	Glove size average man	2 & 3	31.1	± 1.5	2 & 3	21.5	± 1.2
III- 5	Width full size bed	2 & 3	2.4	± .61	2 & 3	3.3	± .56



Section I

It will be recalled that Section I asked for information concerning the way in which certain commodities are sold. Since most of these are common to all sections of the country, it would seem reasonable to expect that experience rather than school might be the basis for the responses. What do the data reveal?

I-1 Farmland The highest percentage of correct responses for farmland as shown in Table VI is carried by number "2", (Experience) in both city and rural. For the city the percentage for number "1", (School) is almost as high as for number "2", with a percentage difference of 1.5 ± P.E. 1.9. There is a significant percentage difference in the rural of 35.2 ± P.E. 2.49 between 59.7 percent for number "2" and 24.5 percent for number "1" as shown in Table VII. The percents for "N" (No number) and "3", (Guess) both city and rural are very small.

I-2 Potatoes Potatoes carry a still higher percentage of correct responses for number "2", (Experience) than does farmland. For the city 58.9 percent of the boys and girls indicate experience, number "2", as the basis for their answers. There is a significant percentage difference of 34.0 ± P.E. 1.8 between it and the next highest percent of 24.9 for number "1", (School). Experience is also the basis for the answers among the rural children. 68.8 percent of the correct responses are carried by number "2", against 19.7 percent for number "1" or a significant percentage difference of 49.1 ± P.E. 1.7. The percentages for "N" (No number) and "3" (Guess) are very insignificant.

I-3 Cotton Lint The responses on this item would seem to indicate that these boys and girls are not familiar to any great extent with the way in which cotton lint is sold. Table VI shows that number "3", which indicates a mere guess, carries the highest percents in both city and rural. For the city the percentage is 17.7 against 4.9 for number "2", the next highest, or a percentage difference of 12.8 ± P.E. 1.3. For the rural the percentage is even higher, 22.2 against 5.5 for number "2", the next highest, or a percentage difference of 16.7 ± P.E. 1.2. These are both significant differences in favor of number "3". The percents for "N" (No Number), "1", (School), and "2", (Experience) are very small for both city and rural.

I-4 Eggs Eggs carries the highest percentages of any of the items in Table VI. Number "2" was placed opposite 64.1 percent of the total percent of 96.1 for the city. There is a significant statistical percentage difference of 37.7 ± P.E. 1.8 between it and the next highest percent of 26.4 carried by number "1". The percentage is even higher for the rural, for 72.9 percent is carried by number "2", (Experience) as compared to 20.6 percent for number "1", (School) or a very significant percentage difference of 52.3 ± P.E. 1.6 as shown in Table VII. Again "N", (No Number) and number "3" (Guess) percentages are very small.

I-5 Coal Table VI shows that number "2" carries the highest percentages of correct responses in both city and rural. The percentage difference between 46.4 for number "2" (experience) and 28.5 for number

"1" (School) in the cities is 17.9 ± P.E. 1.9. The difference for the rural is even greater with 54.1 percent for number "2" and 23.3 percent for number "1" or a percentage difference of 30.8 ± P.E. 1.7. These differences are both statistically significant in favor of number "2", experience.

I-6 Nails The story for nails differs from that of coal in that the larger percentages of correct answers fall under numbers "2", (Experience) and "3" (Guess) rather than "1" (School) and "2" (Experience). The percentage in the city for number "2" is 33.1 against 27.8 percent for number "3" or a percentage difference of 5.3 ± P.E. 1.8. The difference here is negligible. For the city number "2" carries 45.7 percent as compared to number "3" with 20.4 percent. This gives a significant percentage difference of 25.3 ± P.E. 1.7 in favor of experience. (Table VII).

I-7 Wood Number "2" (Experience) leads with the highest percentages. The percentages for numbers "1" (School) and "3" (Guess) are almost the same in both city and rural, with number "3" slightly higher. There is a significant percentage difference in the city of 33.3 ± P.E. 1.7 between 46.2 percent for number "2" as compared to 12.9 percent for number "3". In the city number "2" carries 37.7 percent of correct responses as compared to 12.7 for number "3" or a significant percentage difference of 25.0 ± P.E. 1.6.

The data for the 7 measures of Section I are shown in a graphic way in Figures 5 and 6.

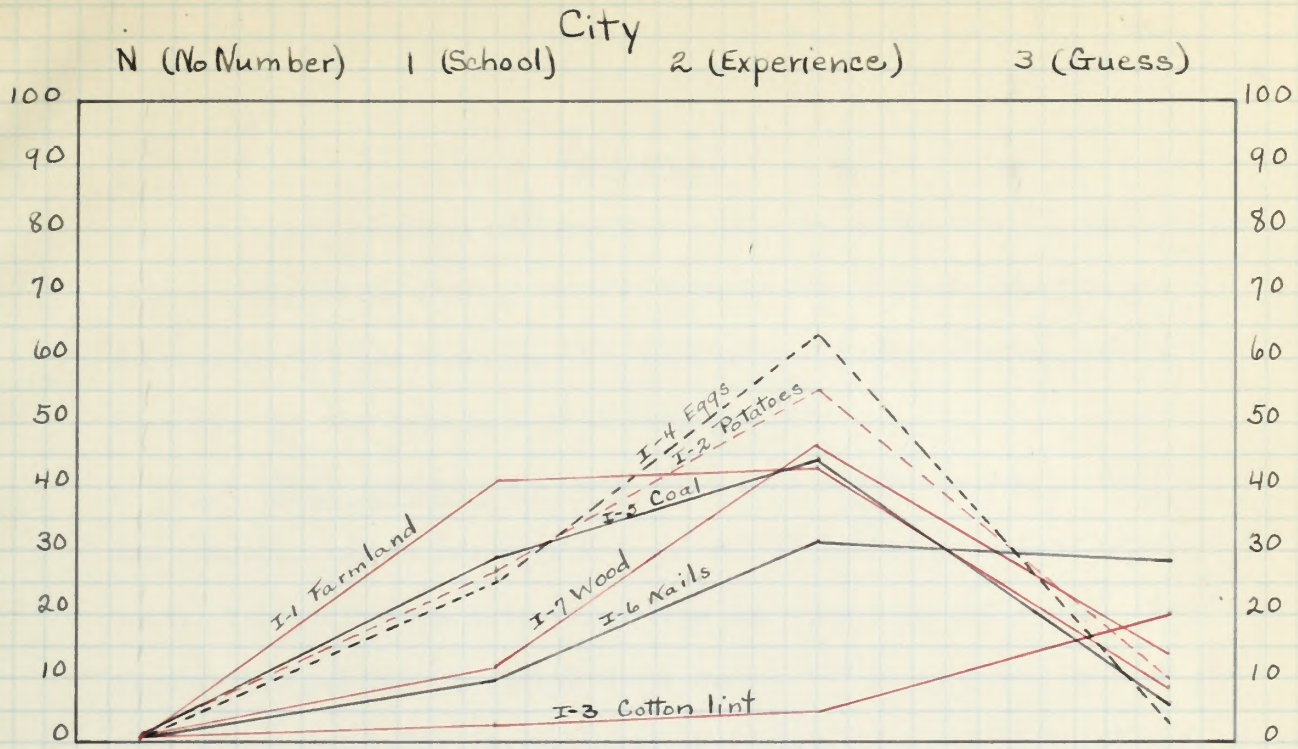


Fig. 5 Showing Graphically the Percentage of Correct Answers, Indicated by "N" (No Number), "1" (School), "2" (Experience), "3" (Guess), on Section I for the City, Boys and Girls Combined, for Five Selected States

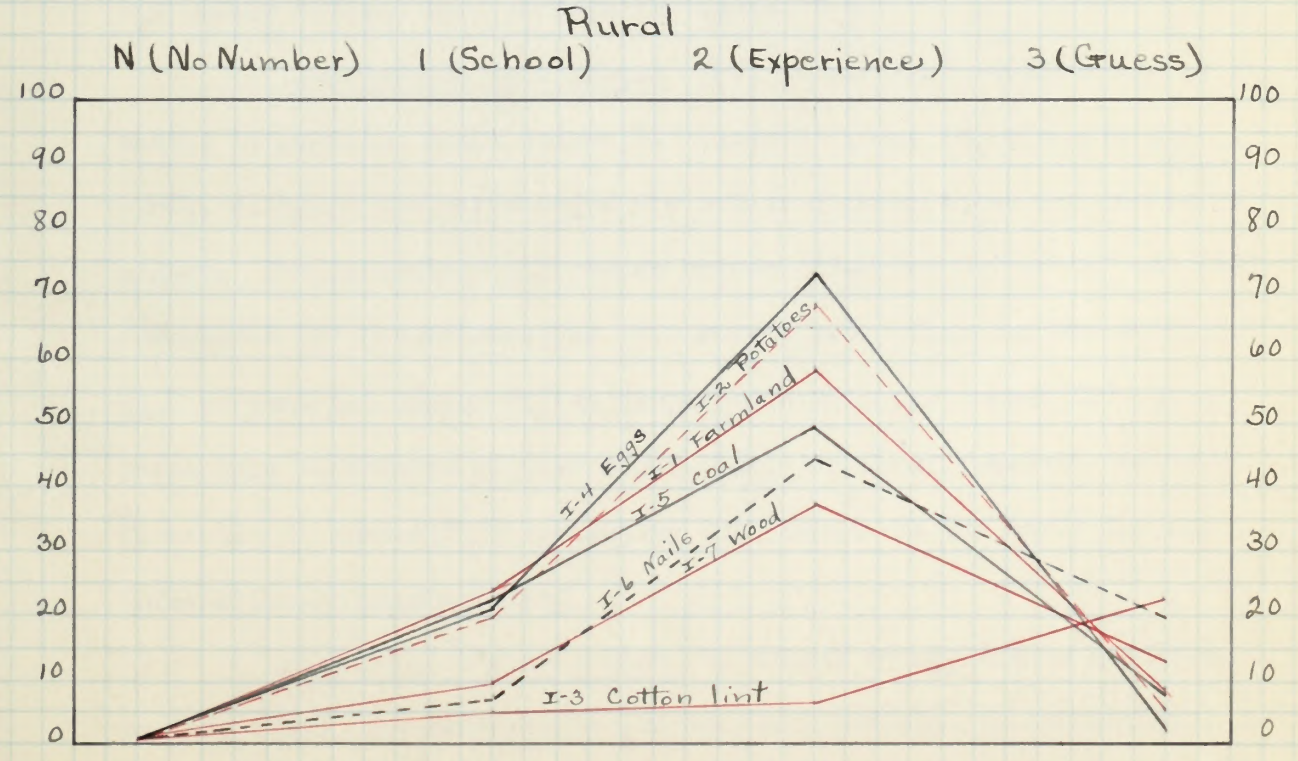


Fig. 6 Showing Graphically the Percentage of Correct Answers Indicated by "N" (No Number), "1" (School), "2" (Experience) "3" (Guess) on Section I, for the Rural, Boys and Girls Combined, for Five Selected States

Section II

The nature of the measures included in Section II would indicate a variance on the different items in the highest percentages carried by "N" (No Number), "1", (School), "2" (Experience), and "3" (Guess). Do the data bear this out, or not?

II-1 Inches in a Foot This is a measure commonly taught in the schools, and is one in which number "1" (School) would be expected to lead. Table VI shows this to be true for both city and rural. In the former 75.0 percent is listed under number "1" as compared to 13.8 percent under number "2" (Experience) or a statistical significant percentage difference of 61.2 ± P.E. 1.5. Number "1" in the rural leads with a high significant percentage difference of 60.5 ± P. E. 1.5 between 75.2 percent for number "1" and 14.7 percent for number "2".

II-2 Seconds in a Minute This is another measure commonly taught in school. Again number "1" (School) leads in both city and rural, although the percentages are not as high as those for inches in a foot. The percentage difference between 62.8 for number "1" and 23.9 for number "2" (Experience) is 38.9 ± P.E. 1.8. That for the rural is 53.0 percent for number "1" as compared to 25.4 for number "2", or a percentage difference of 27.6 ± P.E. 1.8. These differences are both favorable to number "1", indicating that school is the basis for the information on this measure.

II-3 Cups Milk in a Pint Is school or experience the story on this item? The percentages for the city indicate no statistical significant difference between the two as shown in Tables VI and VII. Number "1" (School) carries 25.8 percnnt while number "2" (Experience)

carries 23.0 with a difference of 2.8 ± P.E. 1.6. Number "3" (Guess) comes third with 20.5 percent. For the rural number "1" leads with 25.4 percent followed by number "3" with 20.7 percent or a non-significant difference of 4.7 ± P.E. 1.6. Number "2" is third with 15.3 percent.

II-4 Cubic Inches in a Cubic Foot This measure is one taught in the schools in the higher grades. It follows that number "1" (School) should carry the highest percentage of correct responses. This is true but the percentages run very low. Of the total percent of 18.5 for the city, number "1" leads with 14.1 percent. The next highest is 2.6 percent for number "3" (Guess), with a percentage difference between the two of 11.5 ± P.E. 1.0. For the rural the percentage difference is 6.1 ± P.E. .67 between 7.0 percent for number "1" and .9 percent for number "3". These percentages seem to indicate that this is a measure for which there is little use, and though once learned it is soon forgotten. Chapter VII will show differences, if any, by grades.

II-5 Acres in a Quarter Section The total percentages of correct responses for this measure as seen in Table VI are very small with 7.2 for city and 3.5 for rural. Of the 7.2, number "1" (School) carries 3.2 as compared to 2.6 for number "3" (Guess) or a percentage difference of .6 ± P.E. .66. (Table VII) The percentage difference between 1.5 for number "1" (School) and 1.1 for number "3" (Guess) is .4 ± .44. These differences are negligible.

II-6 Pounds in a Bushel of Wheat The highest percentage of correct responses for this measure are carried by number "3" (Guess) as shown in Table VI. 6.9 percent of the city pupils indicated number "3"

as compared to 2.5 percent for number "1" (School), while 8.3 of the rural pupils indicated number "3" as compared to 2.9 for number "2" (Experience). The percentage differences, as shown in Table VII, are 4.4 ± P.E. .79 and 5.4 ± P.E. .95 respectively. The differences are very small in favor of number "3", a guess.

II-7 Pennyweight in an Ounce This measure shows very small percentages and percentage differences as indicated in Tables VI and VII. Number "1" (School) leads in the city with only 1.1, while number "2" (Experience) carries no percent and number "3" (Guess) only .9 percent. In the rural number "3" leads with 1.6 percent, while number "2" carries no percent and number "1" only .5 percent. The percentage differences between number "1" and number "3" for both city and rural are insignificant.

II-8 Dozen Eggs in a Crate This is a measure which, in general, is not taught in school. It follows then that either number "2" (Experience) or "3" (Guess) ought to carry the highest percentage of correct responses. In the city number "3" leads with 2.1 percent followed by number "2" with 1.6 percent or a percentage difference of .5 ± P.E. .53. The story is the reverse for the rural as number "2" leads with 4.9 percent as compared to 2.3 for number "3", or a percentage difference of 2.6 ± P.E. 71. In view of the facts presented in Chapter IV under this item, number "2" (Experience) would be expected to lead, although the differences, as indicated above, are not statistically significant.

II-9 Rods in a Mile Although this measure is taught in school, yet the percentages of correct responses as shown in Table VI are low with 14.9 for city and 15.3 for rural. Number "1" (School) leads in

both city and rural followed by number "3" (Guess). The percentage difference for the city is 6.1 ± P.E. .87 between 9.7 percent for number "1" and 3.6 for number "3". That for the rural is 8.4 ± P.E. .90 between 10.8 for number "1" and 2.4 for number "3". Though small, these are statistically significant differences.

II-10 Pecks in a Bushel Number "1" (School) carries the highest percentage of correct responses in both city and rural, followed by number "3" (Guess) in city and with equal percentages for numbers "2" (Experience) and "3"(Guess) in rural. In the city the percentage difference between 35.4 percent for number "1" and 8.1 percent for number "3" is 27.3 ± P.E. 1.5. The percentage difference in the rural is practically the same, being 27.7 ± P.E. 1.5 between 34.9 percent for number "1" and 7.2 percent for either number "2" or number "3". The responses here are favorable to number "1". It is a very commonly taught measure as well as one of the more useful ones.

II-11 Average Yield of Cotton Per Acre On this item either number "2" (Experience) or number "3" (Guess) would be expected to lead in the highest percentage of correct responses. For these five states, which are truly representative as will be pointed out a little later, number "3" (Guess) carries the highest percentages in both city and rural. The percentage difference between 0.7 percent for number "2" and 6.2 percent for number "3" is 5.5 ± P.E. 0.7 for the city with one of 2.8 ± P.E. .65 between 1.8 percent for number "2" and 4.6 percent for number "3" for the rural. The former is favorable to number "3" (Guess), while the latter percentage difference is negligible, even though the percentage

for number "2" (Experience) is greater than that for number "3" (Guess). A glance at the percentages for the State of Texas[1] alone, in the cotton belt, shows them to be much higher than those for any of the other five states. In view of these data it is apparent that these children knew something about cotton yields but possibly were not real positive and so placed "3" rather than "2" opposite the given responses.

II-12 Average Yield of Wheat Per Acre The percentage differences for both city and rural on this item are significantly favorable to number "3" (Guess), as shown in Tables VI and VII. In the city the difference between 12.6 percent for number "3" and 2.3 percent for number "2" (Experience is 10.3 ± P.E. 1.0 while that for the rural is 6.0 ± P.E. .96 between 9.8 percent for number "3" and 3.8 percent for number "2". The data for the separate states shows fair percentages for all but Massachusetts. The others being states in which considerable wheat is grown, would be expected to yield fair returns. The explanation given for II-11 as to the larger percentages for number "3" (Guess) may be equally applicable here.

Figures 7 and 8 show the data on this section for items 1-6, 9, and 10.

Section III

Each item in this section, except III-5, width of full size bed, for city, shows statistical significant percentage differences in favor of number "3" (Guess). None of the percentages are very large as

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1. Data for the five states distributed on the basis of "N", "1", "2", and "3" are found in Appendix C.

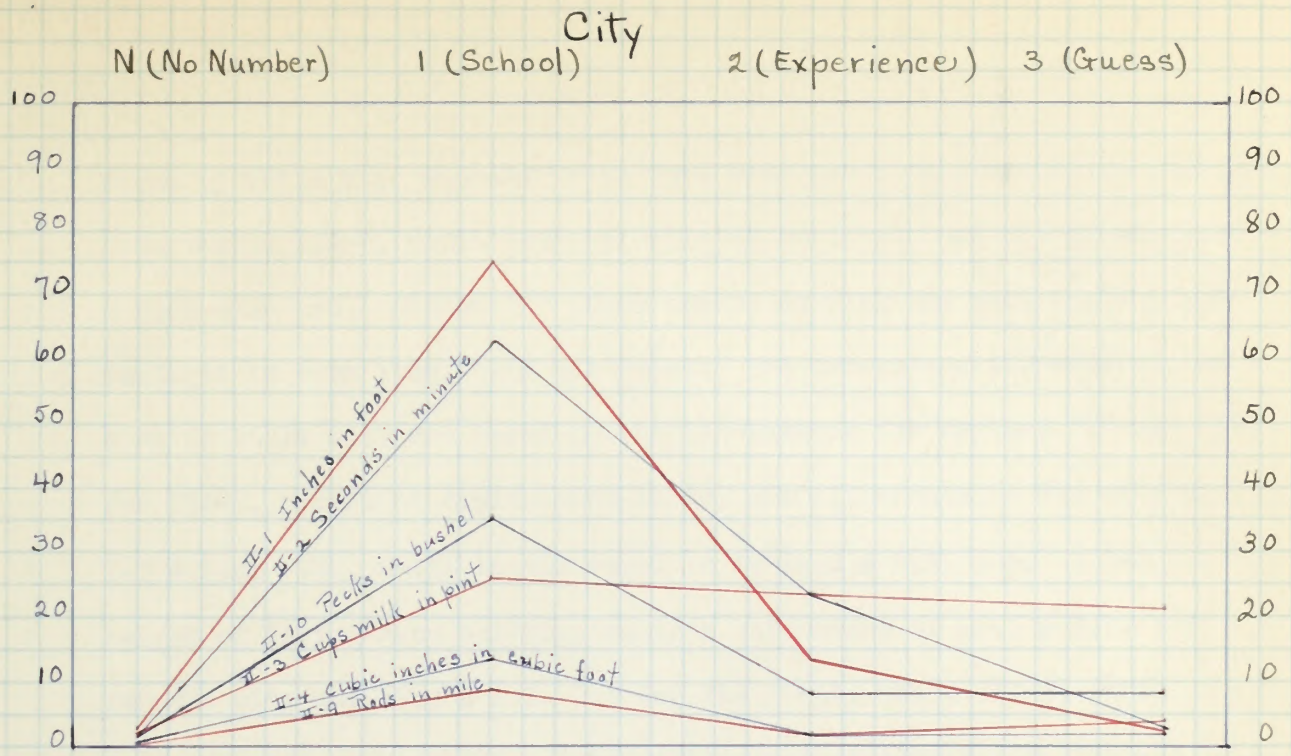


Fig. 7 Showing Graphically the Percentage of Correct Answers, Indicated by "N" (No Number), "1" (School), "2" (Experience) "3" (Guess), on Section II, Items 1-4, 9, 10 for the City, Boys and Girls Combined, for Five Selected States

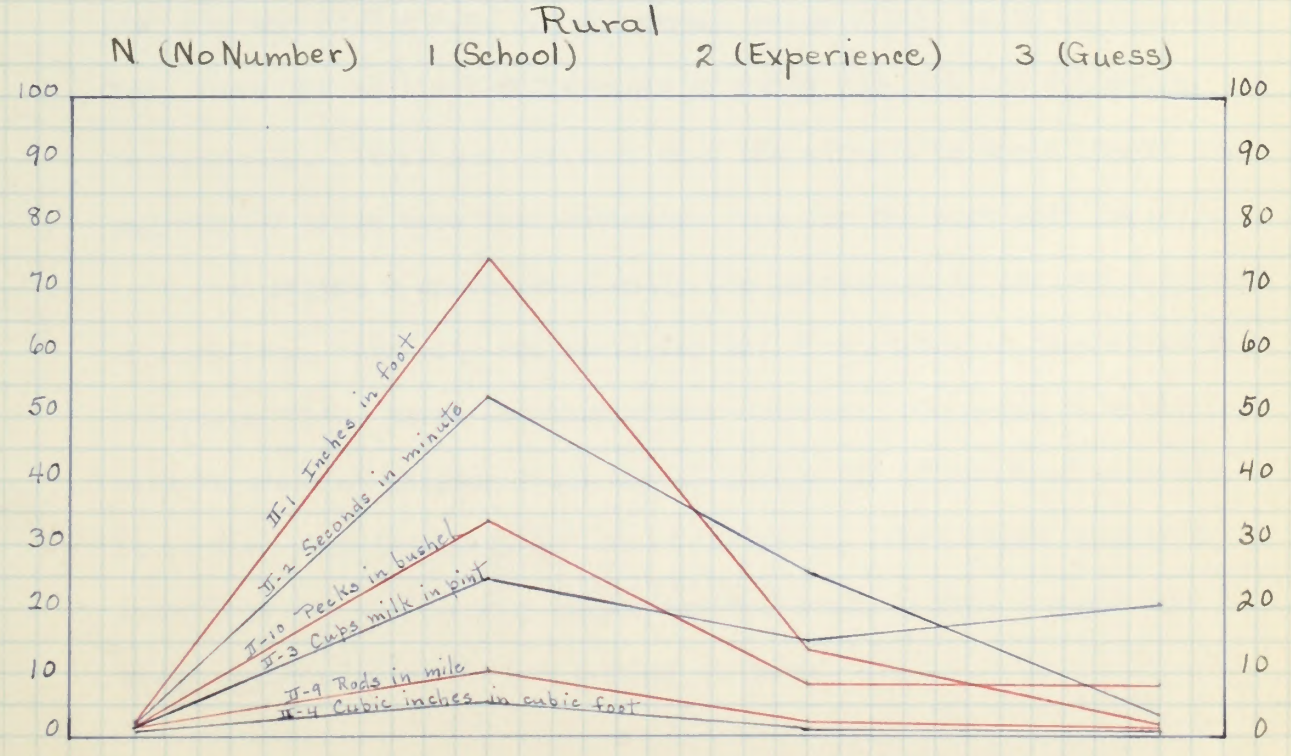


Fig. 8 Showing Graphically the Percentage of Correct Answers, Indicated by "N" (No Number), "1" (School), "2" (Experience), "3" (Guess), on Section II, Items 1-4, 9, 10, for the Rural, Boys and Girls Combined, for Five Selected States

shown by Table VI. Especially is this true for III-1, height of dining-room table, III-3, width between rails of railroad, and III-5, width of a full size bed. Number "2" (Experience) carries the next highest percentages in each item, city and rural. The percentage differences, as seen in Table VII, are based on the percentages for numbers "2" and "3". For III-1, height of dining-room table, the difference in the city is 7.7 ± P.E. .74, while in the rural it is 54.0 ± P.E. .66. III-2, height of living-room ceiling, shows a difference of 26.7 ± P.E. 1.5 for the city and 17.9 ± P.E. 1.3 for the rural, while III-3, width between rails of railroad, shows differences of 13.6 ± P.E. 1.1 and 18.8 ± P.E. .99 for each respectively. Item III-4, glove size of average man, shows the greatest percentage differences being 31.1 ± P.E. 1.5 for city and 21.5 ± P.E. 1.2 for rural, while III-5, width of full size bed, shows the smallest differences of 2.4 ± P.E. .61 and 3.5 ± P.E. .56 respectively. It is very evident that the answers to these items, the majority of which were fair estimates, are for the most part guesses.

Figure 9 shows graphically the percentage of correct responses on each item, both city and rural for the five states of Massachusetts, Minnesota, Ohio, Texas and Washington combined. Comparing this figure with Figure 4 of Chapter V for the 43 States and District of Columbia it is seen that the curve is almost identical. This shows without a doubt that the five states chosen for treatment in this chapter are truly representative of the country at large.

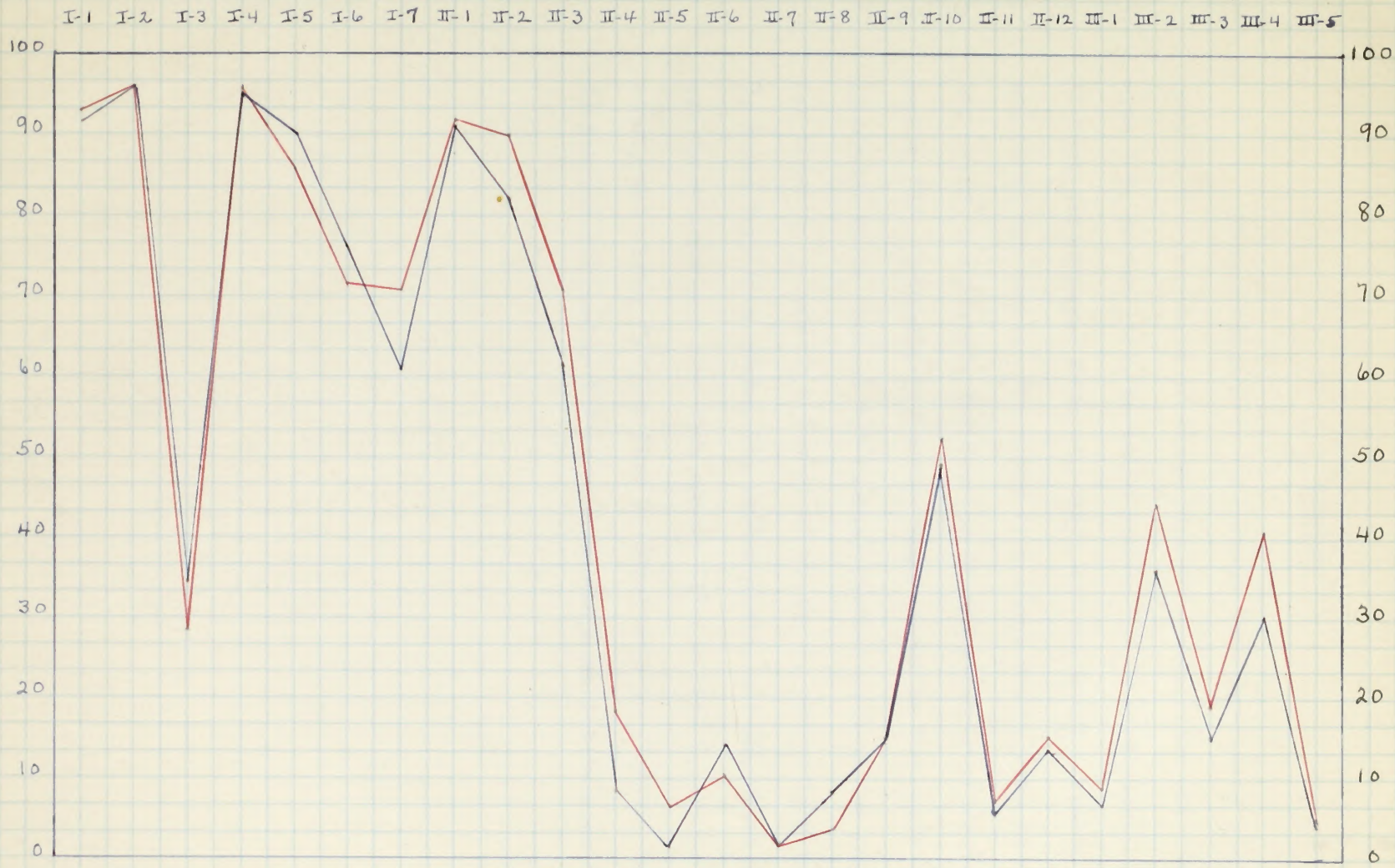


Fig. 9 Showing Graphically the Percentage of Correct Answers on Sections I, II, and III, City and Rural, for Five Selected States

— City — Rural

Summary

From Section I it is obvious that experience plays the larger part in the responses of these boys and girls. The one exception is with I-3, cotton lint, in which number "3", a mere guess, shows the highest percentage. Even so, they, and the total percents for both city and rural are small. The first five items and 9, rods in a mile, and 10, pecks in a bushel, for Section II carry larger percentages for number "1", (School), indicating that school is the basis of the knowledge here. Number "3" (Guess) carries most of the highest percentages for items 6, pounds in a bushel of wheat, 7, pennyweight in an ounce, 8, dozen eggs in a crate, 11, cotton yield, and 12, wheat yield. The two exceptions are city with number "1" for item 7, pennyweight in an ounce, and number "2" for item 8, dozen eggs in a crate, in the rural. In Section III number "3" carries the highest percentages for each item.

CHAPTER VII

Sectional Distribution by Grades

An attempt is made in this chapter to find an answer to the question, Do differences exist at the various grade levels on the measures known and used by children? The same five states, Massachusetts, Minnesota, Ohio, Texas and Washington, have been used for this purpose in noting the distribution of the correct responses by grades. Grades two and ten consist of a very few pupils. In view of this fact the percentages for these grades are not comparable to those of grades three to nine inclusive which carry much larger returns. For instance in grade two if the three children answer correctly the result is 100 percent, whereas if just one child fails to answer, the percentage is greatly reduced to that of 33.3 percent. The reductions on grade nine do not fluctuate as rapidly but even so the number is small compared to those of the other grades. The treatment of the data which follows will tend to center in grades three to nine. Table VIII will serve as a basis for the discussion in this chapter. The percentages for the city and rural have been combined in this table. Tables IX and X (p. 108) show the separate percentages for rural and city.

Section I

In the main the trend of percentages from grade to grade in Section I is consistently higher for each grade. There are two exceptions. For item I-6, nails, there is a very slight falling off beyond the sixth grade, dropping from 81.0 percent in the sixth grade

Table VIII Shows the Distribution, by Grades, of the Percentage of Answers that are Correct or Reasonable on Sections I, II, and III, City and Rural Combined, for Five Selected States.

Number in Each Grade	3	137	144	171	211	202	215	86	9
Grade	2	3	4	5	6	7	8	9	10
I- 1 Farmland	66.7	72.9	83.3	93.5	95.7	95.0	95.3	97.6	100.0
I- 2 Potatoes	66.7	82.4	93.0	94.7	96.6	98.5	98.6	100.0	100.0
I- 3 Cotton lint	0.0	25.5	20.8	31.5	31.4	32.6	33.9	29.1	44.4
I- 4 Eggs	66.7	84.6	94.4	97.0	97.6	97.5	99.0	100.0	100.0
I- 5 Coal	66.7	63.5	83.3	90.0	92.4	93.5	93.9	95.3	88.9
I- 6 Nails	66.7	52.5	61.8	71.9	81.0	79.2	80.9	80.2	77.8
I- 7 Wood	33.3	35.7	51.4	56.1	70.1	77.4	80.4	83.7	88.9
II- 1 Inches in a foot	33.3	84.6	81.9	92.4	94.7	95.5	98.1	98.6	88.9
II- 2 Seconds in a minute	66.7	53.2	63.8	83.6	93.3	97.5	98.1	100.0	88.9
II- 3 Cups milk in pint	33.3	54.0	56.9	64.9	72.5	69.3	73.9	68.3	66.7
II- 4 Cubic inches in cubic foot	0.0	0.0	.7	8.1	13.2	20.7	27.9	16.2	11.1
II- 5 Acres in $\frac{1}{4}$ Section	0.0	0.0	0.0	2.3	3.8	4.4	8.8	18.3	55.5
II- 6 Pounds in Bushel of wheat	0.0	2.9	3.4	7.6	11.3	14.3	24.1	20.9	33.3
II- 7 Pennyweight in ounce	0.0	0.0	.7	4.1	2.3	2.9	1.9	1.2	0.0
II- 8 Dozen eggs in crate	0.0	.7	2.8	4.1	6.1	7.9	10.7	9.5	0.0
II- 9 Rods in mile	0.0	1.4	9.0	5.8	17.0	21.7	24.6	23.2	0.0
II- 10 Pecks in bushel	0.0	11.5	35.4	50.2	61.6	62.8	65.1	54.6	66.7
II-11 Wheat yield per acre	0.0	0.0	2.1	4.1	8.5	5.4	13.0	15.1	11.1
II- 12 Cotton yield per acre	0.0	0.0	1.4	5.8	14.2	21.2	26.4	30.2	33.3
III- 1 Height of dining-room table	33.3	2.1	4.8	2.9	8.5	13.3	7.9	10.4	0.0
III- 2 Height of living-room ceiling	33.3	6.5	12.5	29.8	52.8	54.9	60.4	69.6	88.9
III- 3 Width between rails of railroad	0.0	.7	3.4	15.2	15.7	19.3	28.3	38.1	11.1
III- 4 Glove size of average man	33.3	12.2	14.5	21.6	29.8	47.5	55.8	63.9	88.9
III- 5 Width of full size bed	33.3	0.0	0.0	1.7	3.3	5.4	8.8	12.8	22.2

to 79.2 percent in the seventh grade, 80.9 percent in the eighth and 80.2 percent in the ninth. This difference is too small to be significant. Item I-3, cotton lint, shows a drop in the fourth grade and again in the ninth grade with but a slight rise from the fifth to the eighth grade. Item I-7, wood, shows a very consistent upward trend with a percentage range from 35.7 percent in the third grade to 83.7 percent in the ninth grade. This range is greater than that for any other item of Section I. Apparently children at the lower grade levels are not as familiar with the way in which wood is sold as compared to all the other commodities except I-3, cotton lint, which is still lower. Figure 10 shows these data in graphic form.

The percentages from grade to grade run practically the same for items I-1, farmland, I-2, potatoes, and I-4, eggs. Since they are so similar, only I-4, eggs, is shown in Figure 10. The percentages for each are shown in Table VIII. Item I-5, coal, shows a fairly rapid rise from 63.5 percent in the third grade to 83.3 percent in the fourth grade. Beyond the fourth grade the rise in gradual being especially so in the seventh, eighth and ninth grades.

Section II

Section II shows a story similar to that of Section I, except that the percentages for all items, except items 1 to 3, are much smaller. Figure 11 shows graphically the data for some of the

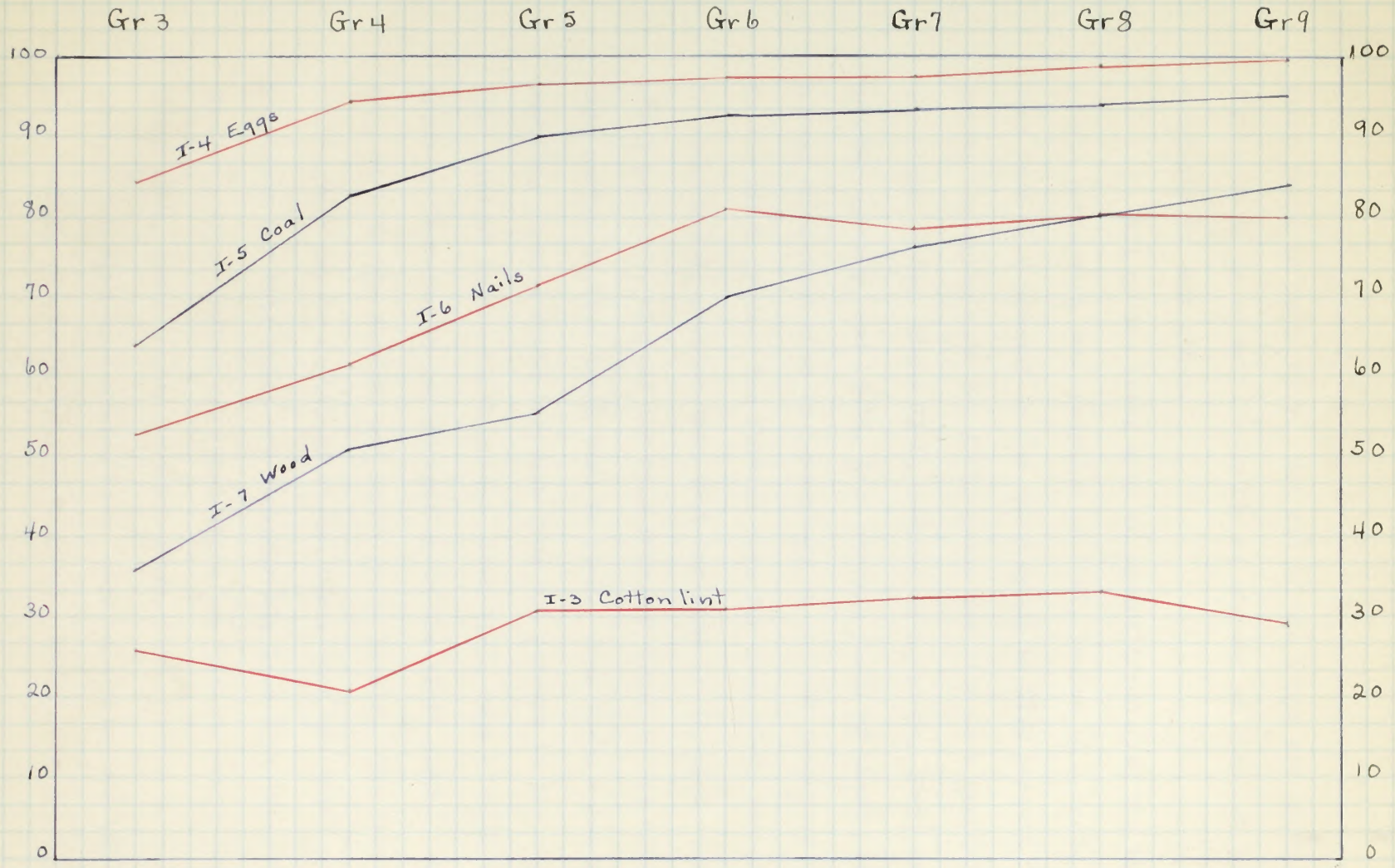


Fig. 10 Showing Graphically, by Grades, the Percentage of Correct Answers on Items 3 to 7 Inclusive of Section I for Five Selected States with City and Rural Combined

items found in Table VIII. Not all of the items are shown. It was difficult to do so satisfactorily as so many of them run in close proximity to each other.

All of the items show an upward trend from the third to the fourth grade with the exception of II-1, inches in a foot. There is a drop from 84.6 percent in the third grade to 81.9 percent in the fourth grade; beginning with the fifth grade the rise is a gradual one up to the ninth grade. Items II-2, seconds in a minute, II-5, acres in a quarter section, and II-12, good average yield of wheat per acre, show a very consistent rise in percentage of correct responses from the third to the ninth grade. The initial rise for item II-2, seconds in a minute, is considerably greater than that for item II-12, good average yield of wheat per acre, whereas the rise from the sixth to the ninth grade is more marked in item II-12 than in II-2. Item II-5, acres in a quarter section, shows a rapid increase from 8.8 percent in the eighth grade to 18.8 percent in the ninth grade. Item II-3, cups of milk in a pint, shows an increase in percentages up to the sixth grade. There is a drop at both the seventh and ninth grade levels. The drop at the ninth grade may be explained on the basis that the total number of responses for this grade are considerably less than those for grades three to eight inclusive. That there are similar drops for this grade in items II-4, cubic inches in cubic foot, II-6, pounds in bushel of wheat, II-8, dozen eggs in a crate, II-9, rods in a mile, and II-10, pecks in a bushel, points to this conclusion. Except for the ninth grade the

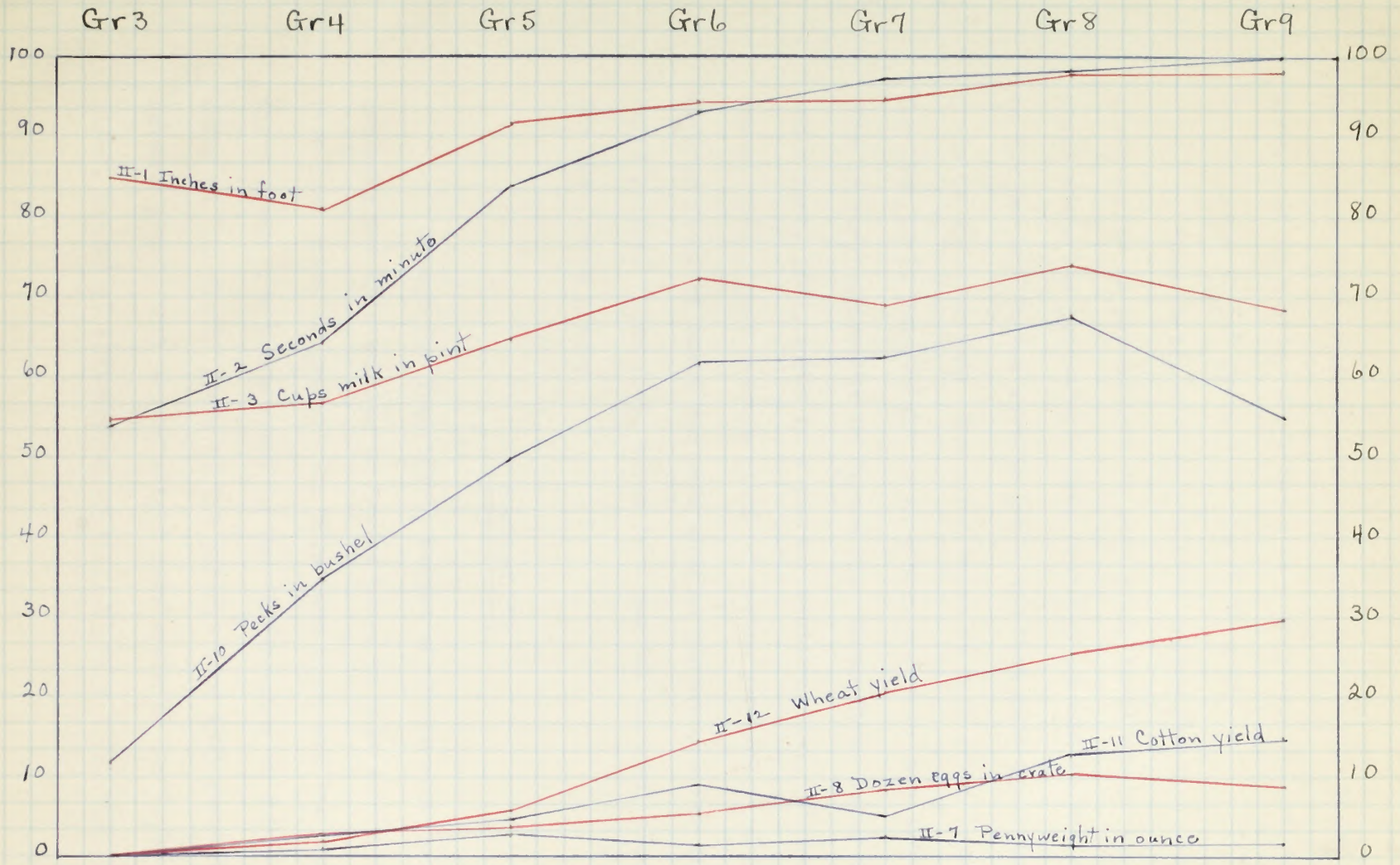


Fig. 11 Showing Graphically, by Grades, the Percentage of Correct Answers on Items II-1, II-2, II-3, II-7, II-8, II-10, II-11, and II-12 for Five Selected States with City and Rural Combined

percentages from grade to grade are greater for all these items except II-9, rods in a mile, where there is a drop from 9.0 percent in the fourth grade to 5.8 percent in the fifth grade.

Item II-11, average yield of cotton per acre, shows a consistent rise in percentages at each grade level except for the seventh grade where the percentages drop from 8.5 percent in the sixth grade to 5.4 percent in the seventh grade and then rise again in the eighth grade to 13.0 percent. The percentages at each grade level are small for item II-7, pennyweight in an ounce, and show very little variation. This is very noticeable in Figure 11. Items II-4, cubic inches in a cubic foot, II-5, acres in a quarter section, II-7, pennyweight in an ounce, II-11, good average yield of cotton per acre, and II-12, good average yield of wheat per acre, show no percentages for the second and third grades. Item II-5, acres in a quarter section, also shows none for the fourth grade.

Section III

Except for Item III-1, height of dining-room table, the percentages for this section in grades three to nine show a consistent rise from grade to grade. For this item there are two drops one at the fifth grade from 4.8 percent in the fourth grade to 2.9 percent and the other at the eighth grade to 7.9 percent from 13.3 percent in the seventh grade, with only a slight rise again in the ninth grade. Item III-2, height of living-room ceiling, shows a very rapid rise in per-

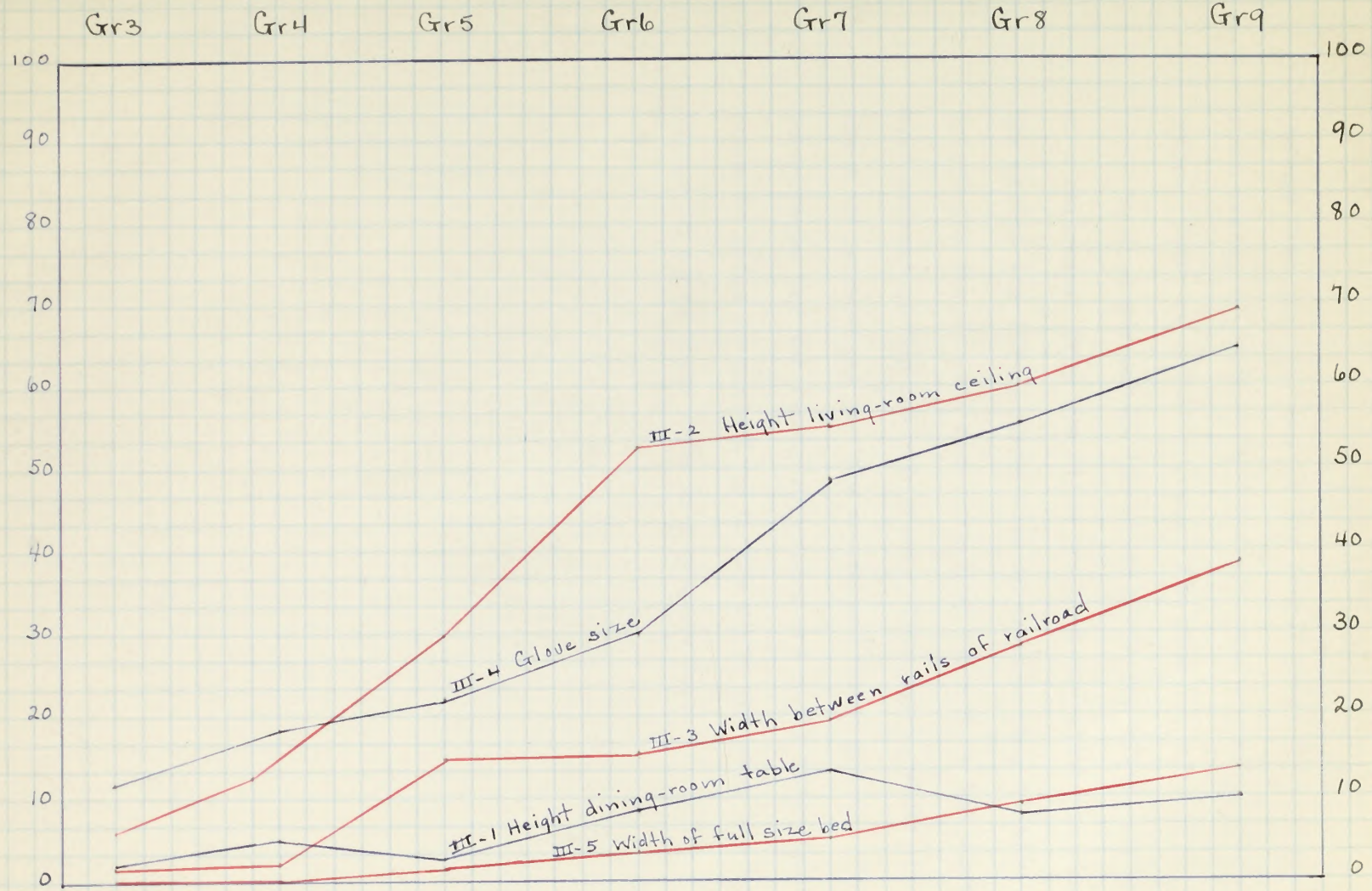


Fig. 12 Showing Graphically, by Grades, the Percentage of Correct Answers on Section III for Five Selected States with City and Rural Combined

centage from 12.5 percent in the fourth grade to 52.8 percent in the sixth grade, at which point there is only a gradual rise up to the ninth grade. There is a fairly rapid rise from 3.4 percent in the fourth grade to 15.2 percent in the fifth grade for III-3, width between rails of a railroad. From the fifth grade to the ninth the rise is gradual. The ascent for III-4, glove size of average man, is also a gradual one except for the decided rise from 29.8 percent in the sixth grade to 47.5 percent in the seventh grade. Item III-5, width of full size bed, shows no percentages for the second and third grades. Even though the percentages for the remaining grades are small their increase from grade to grade is gradual up to the ninth and even the tenth grade. Figure 12 shows these data in a graphic way.

Table IX Shows the Distribution, by Grades, of the Correct Answers on Sections I, II, and III for the Cities of Five Selected States.

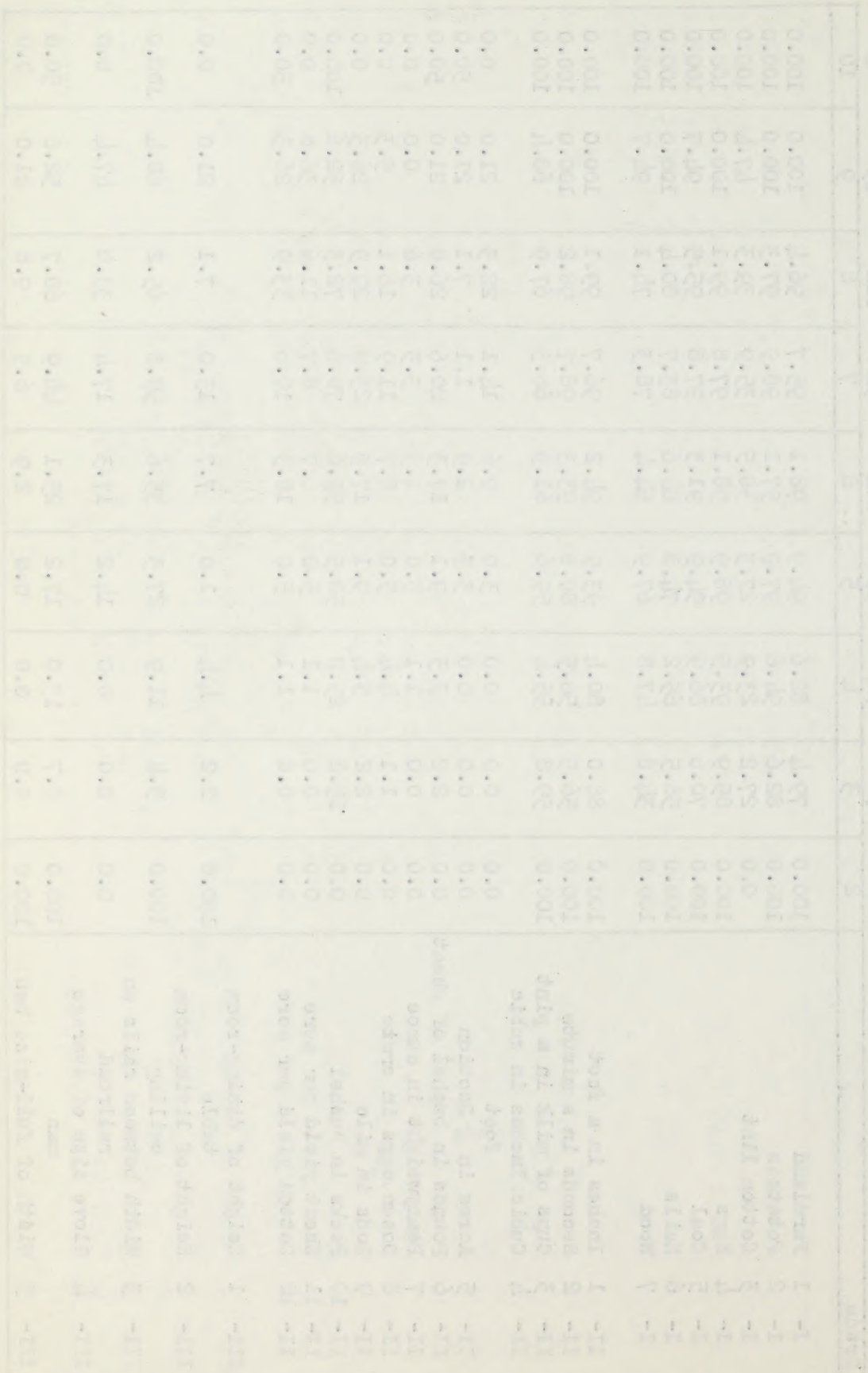
City (565)

No. Pupils In Grade		2	45	52	72	107	110	103	67	7
Grade		2	3	4	5	6	7	8	9	10
I- 1	Farmland	50.0	60.0	84.6	91.7	93.4	94.6	94.1	97.0	100.0
I- 2	Potatoes	50.0	82.2	90.4	90.3	96.2	98.2	100.0	100.0	100.0
I- 3	Cotton lint	0.0	22.2	15.4	37.5	24.3	30.0	28.1	23.9	28.6
I- 4	Eggs	50.0	82.2	96.2	94.4	97.2	97.3	99.0	100.0	100.0
I- 5	Coal	50.0	48.9	76.9	83.3	93.4	90.0	92.2	95.5	85.7
I- 6	Nails	50.0	44.4	55.8	68.1	77.6	75.5	81.5	77.6	71.4
I- 7	Wood	0.0	37.8	57.7	55.6	75.7	76.4	87.4	83.6	85.7
II- 1	Inches in foot	0.0	77.8	84.6	90.3	95.3	94.6	97.1	98.5	85.7
II- 2	Seconds in a minute	50.0	46.7	76.9	87.5	93.4	97.3	98,1	100.0	85.7
II- 3	Cups of milk in pint	0.0	42.2	59.6	72.2	83.1	71.9	80.6	68.7	57.1
II- 4	Cubic Inches in cubic foot	0.0	0.0	1.9	15.3	16.8	26.4	33.9	14.9	14.3
II- 5	Acres in ½ Section	0.0	0.0	0.0	1.4	4.7	11.1	10.7	17.9	57.1
II- 6	Pounds in bushel of wheat	0.0	4.4	3.8	5.6	5.6	9.1	21.3	20.9	28.6
II- 7	Pennyweight in ounce	0.0	0.0	0.0	5.6	2.8	2.8	0.0	1.5	0.0
II- 8	Dozen eggs in crate	0.0	0.0	0.0	2.8	3.7	4.5	4.8	10.4	0.0
II- 9	Rods in a mile	0.0	0.0	15.4	1.4	16.8	20.0	19.4	22.4	0.0
II- 10	Pecks in a bushel	0.0	4.4	53.8	50.0	63.5	56.4	57.2	55.2	57.1
II- 11	Wheat yield per acre	0.0	0.0	3.8	2.8	10.3	2.7	14.5	8.9	14.3
II- 12	Cotton yield per acre	0.0	0.0	1.9	6.9	12.2	22.7	18.4	31.3	28.6
III- 1	Height of dining-room table	0.0	2.2	5.8	5.6	9.3	13.6	8.7	7.5	0.0
III- 2	Height of living-room ceiling	0.0	8.9	13.5	33.3	43.9	50.9	55.3	70.1	85.7
III- 3	Width between rails of railroad	0.0	2.2	9.6	16.7	14.0	20.9	23.3	35.8	14.3
III- 4	Glove size of average man	0.0	20.0	17.3	27.8	36.4	46.4	50.5	67.2	100.0
III- 5	Width of full size bed	0.0	0.0	0.0	1.4	3.7	4.5	7.8	10.4	28.6

Table X Shows the Distribution of the Correct Answers in Sections I, II, and III, by Grades, for the Rural of Five Selected States.

Rural (613)

Grade		No. Pupils In Grade	1	92	92	99	104	92	112	19	2
			2	3	4	5	6	7	8	9	10
I-	1	Farmland	100.0	79.4	82.6	94.9	98.1	95.7	96.4	100.0	100.0
I-	2	Potatoes	100.0	82.6	94.6	97.9	97.1	98.9	97.3	100.0	100.0
I-	3	Cotton lint	0.0	27.2	23.9	27.3	38.5	35.9	39.3	47.4	100.0
I-	4	Eggs	100.0	85.9	93.5	98.9	98.1	97.8	99.1	100.0	100.0
I-	5	Coal	100.0	70.6	86.9	94.9	91.3	97.8	95.5	94.7	100.0
I-	6	Nails	100.0	56.5	65.2	74.8	84.6	83.7	80.4	100.0	100.0
I-	7	Wood	100.0	34.8	47.8	67.9	64.4	78.3	74.1	94.7	100.0
II-	1	Inches in a foot	100.0	88.0	80.4	93.9	94.2	96.7	99.1	100.0	100.0
II-	2	Seconds in a minute	100.0	56.5	56.5	80.8	93.3	96.7	98.2	100.0	100.0
II-	3	Cups of milk in a pint	100.0	59.8	55.4	59.6	61.5	66.3	67.9	68.4	100.0
II-	4	Cubic Inches in cubic foot	0.0	0.0	0.0	3.0	9.6	14.1	22.3	21.0	0.0
II-	5	Acres in $\frac{1}{4}$ Section	0.0	0.0	0.0	3.3	2.9	1.1	7.1	21.0	50.0
II-	6	Pounds in bushel of wheat	0.0	2.2	3.3	9.1	17.3	20.6	26.8	21.0	50.0
II-	7	Pennyweight in ounce	0.0	0.0	1.1	3.0	1.9	3.3	3.6	0.0	0.0
II-	8	Dozen eggs in crate	0.0	1.1	4.4	5.0	8.7	11.9	16.1	5.3	0.0
II-	9	Rods in mile	0.0	2.2	5.4	9.1	17.3	23.9	29.5	26.3	0.0
II-	10	Pecks in bushel	0.0	15.2	25.0	50.5	59.6	70.6	72.3	52.6	100.0
II-	11	Wheat yield per acre	0.0	0.0	1.1	5.0	6.7	8.7	11.6	36.8	0.0
II-	12	Cotton yield per acre	0.0	0.0	1.1	5.0	16.3	19.6	33.9	26.3	50.0
III-	1	Height of dining-room table	100.0	2.2	4.4	1.0	7.7	13.0	7.1	21.0	0.0
III-	2	Height of living-room ceiling	100.0	5.4	11.9	27.3	35.6	59.8	65.2	68.4	100.0
III-	3	Width between rails on railroad	0.0	0.0	0.0	14.2	17.3	17.4	33.0	47.4	0.0
III-	4	Glove size of average man	100.0	8.7	13.0	17.2	23.1	48.9	60.7	52.6	50.0
III-	5	Width of full-size bed	100.0	0.0	0.0	0.0	2.9	6.5	9.8	21.0	0.0



It may be of interest to the reader to note the percentages on each item of Sections I, II, and III for the city and rural separate. These have been placed in Tables IX and X and included in this chapter.

Summary

From the above data, the answer to the question, "Do differences exist at the various grade levels?" is obvious. For each item of the three sections the trend is an upward one from the lower to the higher grades. This is directly in line with the findings of the Wilson study.[1] It is evident that maturity is a vital factor in the measures known and used. This is noticeable for Section III in which number "3", a guess, leads in the highest percentage of correct responses as pointed out in Chapter VI. When the exact measure was not known and a guess was made, maturity apparently aided in the estimates given. Doubtless maturity and experience are more closely connected than maturity and schooling; data are not in form for figuring correlations.

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1. Wilson, D., op. cit. pp. 44, 45, 61, 62, 71, 72.

CHAPTER VIII

DISTRIBUTION OF THE DATA BY SEXES

Do boys and girls differ in their knowledge and use of measures and denominate numbers? If differences do exist what is the significance attached to them? These are questions which this chapter seeks to answer.

The presentation of the material will center in four topics namely, (1) sex differences in city and rural, (2) sex differences on the basis of "N", (No Number), "1" (School,) "2", (Experience) and "3", (guess) (3) sex differences at the various grade levels, and (4) the significance of the percentage difference between the sexes. Topics two and three are based upon the tabulations of the data for the five selected states noted in Chapters V and VI. The first and fourth topics are based upon the data for the 43 states and the District of Columbia as found in Chapter IV. No attempt is made in the discussion of the first three topics to note the probable error of the percentage differences. This will be done for city and rural combined under the fourth topic.

1. Sex Differences in City and Rural

Table XI shows the percentage of correct responses for both boys and girls in city and rural. Figures 13, 14, and 15 show the same data in graphic form. In Section I it is obvious from items I - 5, coal, 1 - 6, nails, and 1 - 7, wood, that the boys score higher

Table XI. Shows the percentage of correct answers on all items of Sections I, II, and III for Boys and Girls in the 43 States and the District of Columbia

		City (4249)		Rural (2327)	
		Boys (1969)	Girls (2277)	Boys (1205)	Girls (1122)
I- 1	Farmland	91.4	90.5	93.3	92.2
I- 2	Potatoes	94.6	95.1	94.9	92.7
I- 3	Cotton lint	26.7	25.5	28.8	31.8
I- 4	Eggs	96.8	96.0	94.0	92.1
I- 5	Coal	84.8	79.7	89.0	82.1
I- 6	Nails	77.2	59.3	73.9	67.0
I- 7	Wood	61.3	56.5	65.8	65.1
II- 1	Inches in a foot	93.1	89.7	91.9	88.1
II- 2	Seconds in a minute	92.0	85.9	80.6	85.1
II- 3	Cups of milk in a pint	72.1	68.4	70.8	71.6
II- 4	Cubic inches in a cubic foot	18.4	15.6	16.6	14.2
II- 5	Acres in $\frac{1}{2}$ section	9.9	6.1	11.3	6.9
II- 6	Pounds in a bushel of wheat	14.1	8.3	20.1	10.4
II- 7	Pennyweight in an ounce	3.4	3.2	4.6	4.3
II- 8	Dozen eggs in a crate	5.2	4.1	9.7	8.1
II- 9	Rods in a mile	14.7	12.8	16.8	13.7
II- 10	Pecks in a bushel	60.6	55.9	58.8	58.6
II- 11	Good average yield of cotton per acre	5.1	3.4	7.1	4.1
II- 12	Good average yield of wheat per acre	11.9	8.3	14.8	9.1
III- 1	Height of dining-room table	8.5	8.1	8.9	8.5
III- 2	Height of living-room ceiling	44.6	32.9	40.2	34.3
III- 3	Width between rails of railroad	26.1	12.3	27.5	13.6
III- 4	Glove size of average man	32.7	31.8	32.4	31.7
III- 5	Width of full size bed	6.3	5.1	4.7	5.9

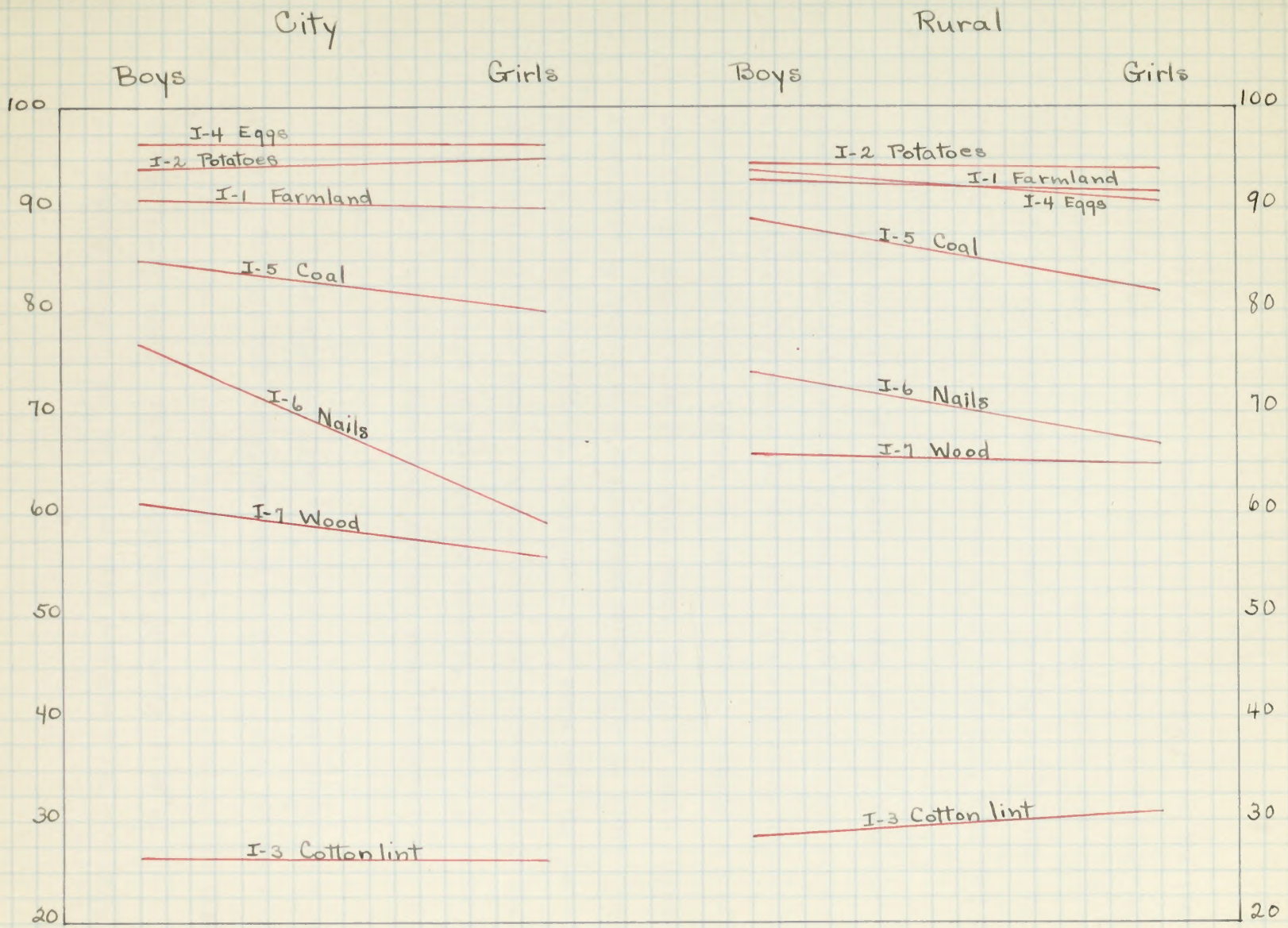

Fig. 13 Showing Graphically the Percentage of Correct Answers on Section I for Boys and Girls, City and Rural, for the 43 States and District of Columbia

than the girls. The percentage of correct responses on the item 1- 6, nails, for the boys in both city and rural is considerably higher than that for the girls. This is especially true in the city. Item 1- 3, cotton lint, shows the girls scoring higher than the boys. Items 1- 1, farmland, 1- 2, potatoes, and 1- 4,eggs, show very slight differences.

On each item of Section II in the city the boys score higher than the girls, with item 1- 7, pennyweight in an ounce, showing only a very slight difference. In the rural the boys score higher on all the items, some very slightly so, except II- 2, seconds in a minute, and II- 3, cups of milk in a pint, where the girls score higher. For items III- 1, height of a dining-room table, III- 4, glove size of an average man, and III- 5, width of a full size bed, the percentages are practically the same. This is very obvious from Figure 15. Items III- 2, height of living-room ceiling, and III- 3, width between rails of a railroad, show that the boys score higher in both city and rural.

It is apparent from the above data that differences do exist between the boys and girls, at least on the majority of the items. How significant these differences are, will be shown in the discussion of the fourth topic. It will show the probable error of the percentage differences between the two sexes with city and rural combined.

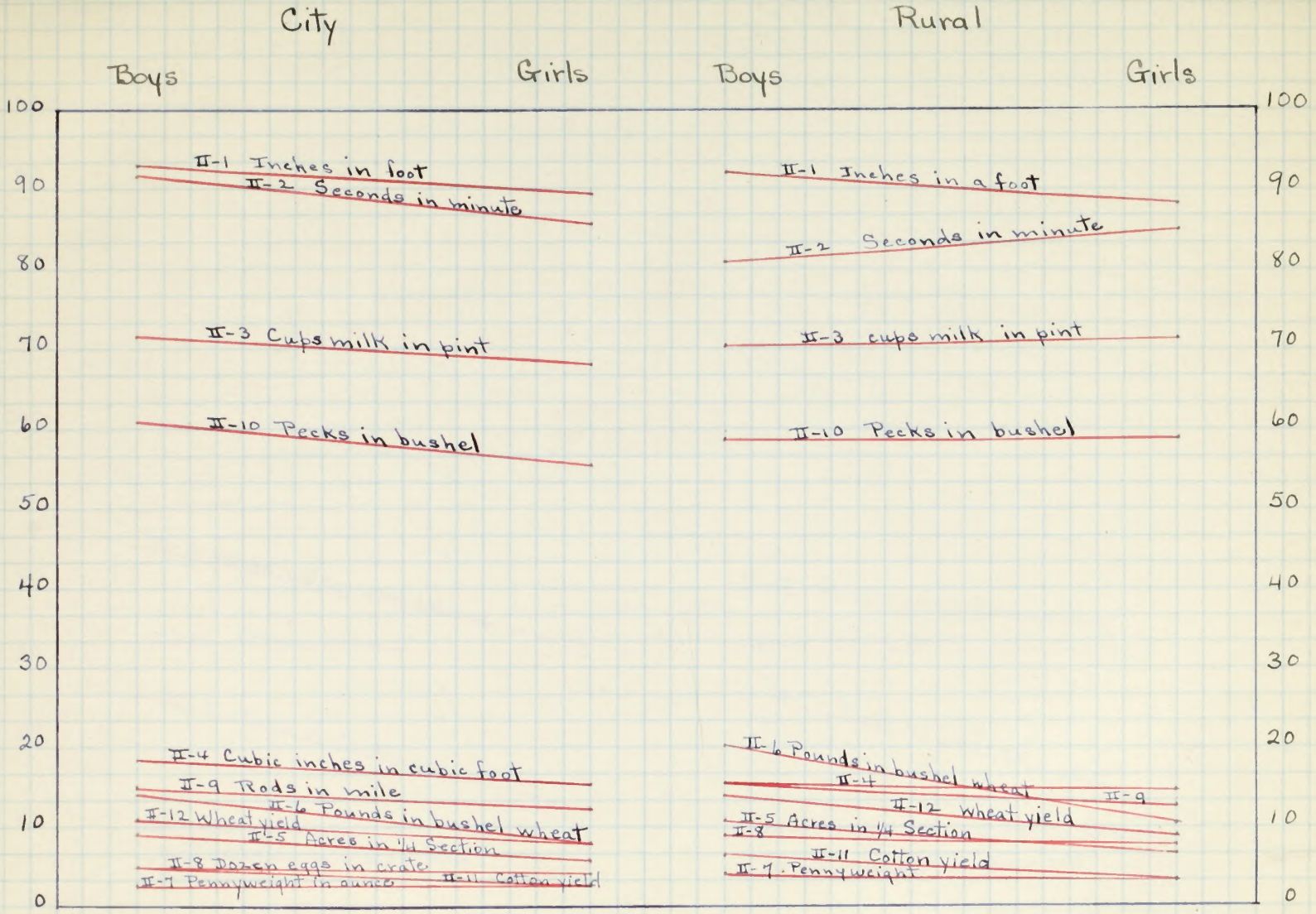

Fig. 14 Showing Graphically the Percentage of Correct Answers on Section II for Boys and Girls, City and Rural, for the 43 States and District of Columbia

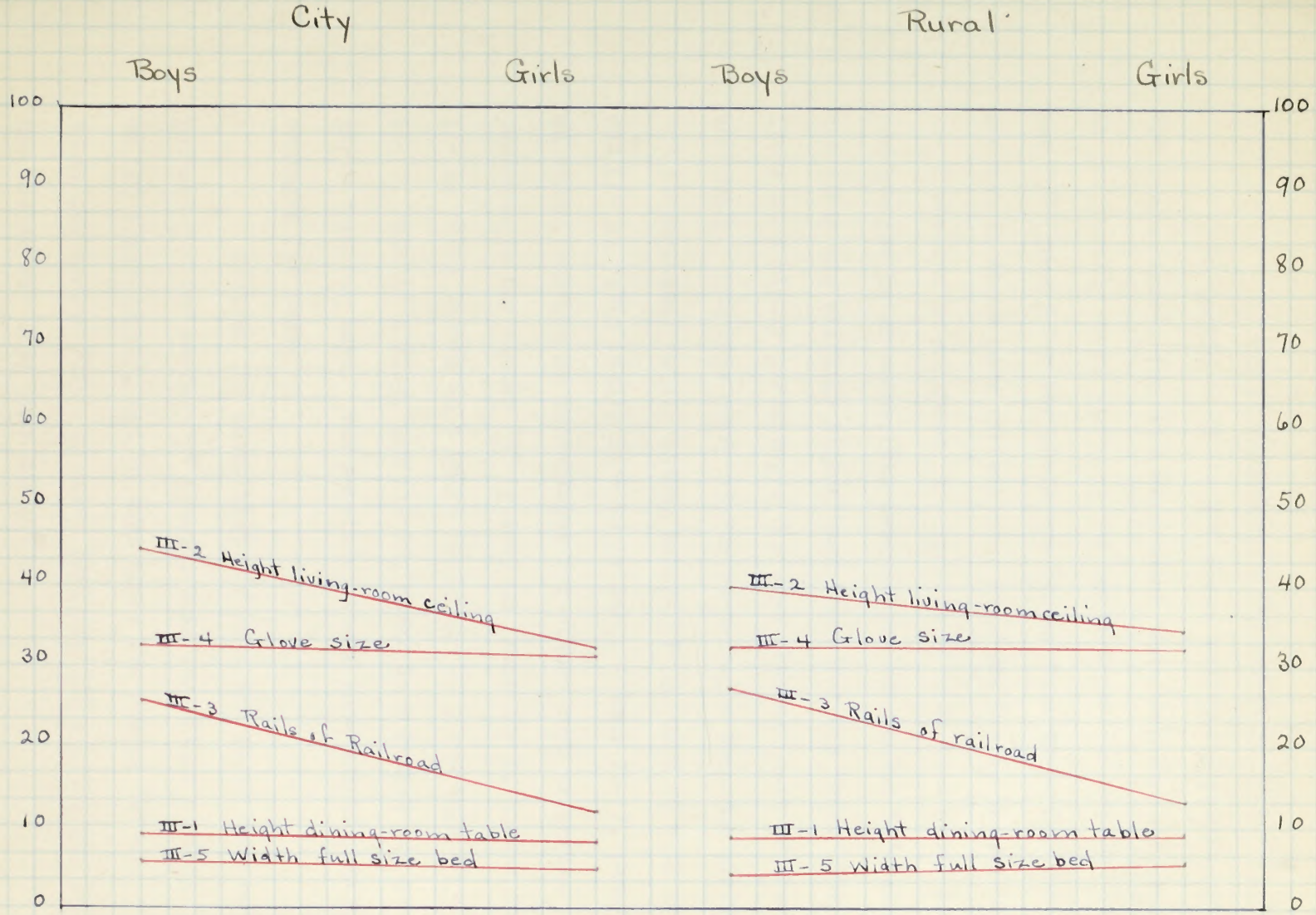

Fig. 15 Showing Graphically the Percentage of Fair Estimate Answers on Section III, for Boys and Girls, City and Rural, for the 43 States and District of Columbia

2. Sex Differences on the Basis of "N", "1", "2", and "3"

In Section I Table XII shows that the percentages for number "2" (experience), for boys is greater than that for the girls, whereas in practically every instance the percentages for number "1" (school) and "3" (guess) for the girls are higher than those for the boys. Section II shows more variations. On items II- 1, inches in a foot, II- 2 seconds in a minute, II- 3, cups of milk in a pint, and II- 7, pennyweight in an ounce, the percentages for number "1" (school) for the girls are slightly higher than those for the boys. The remaining items show higher percentages for boys although most of the differences are small. The boys carry higher percentages than the girls for number "2" (experience) on all items, except II- 3, cups of milk in a pint, and II- 4, cubic inches in a cubic foot. Items II- 7, pennyweight in an ounce, carries no percentages for either boys or girls. The percentages for number "3" (guess) on items II- 1, inches in a foot, II- 4, cubic inches in a cubic foot, II- 8, dozen eggs in a crate, II- 9, rods in a mile, and II- 10, pecks in a bushel are greater for girls than for boys. The remaining items show slightly higher percentages for boys.

Section III shows that the boys and girls both carry higher percentages for number "3" (guess) than for either numbers "1" (school) or "2" (experience), and in turn those for number "2" are higher than those for number "1". In every instance the percentages for number "2" are higher for boys than for girls.

Table XII Shows the Distribution of the Percentage of Correct Answers for Each Item of Sections I, II, and III on the Basis of "N", (no number), "1" (school), "2" (experience), and "3" (Guess), for Boys and Girls in Five Selected States.

		Boys (567)					Girls (611)				
		N	1	2	3	Total	N	1	2	3	Total
I- 1	Farmland	.7	26.6	58.7	5.9	91.9	.3	37.8	44.8	7.3	90.2
I- 2	Potatoes	.8	19.4	69.3	5.3	94.9	.9	24.9	59.2	10.3	95.4
I- 3	Cotton lint	.2	5.1	7.6	15.3	27.2	.0	4.1	3.1	24.4	31.6
I- 4	Eggs	.8	20.1	73.4	1.6	95.9	.6	26.3	64.3	4.7	95.9
I- 5	Coal	1.4	24.5	55.9	7.7	89.6	1.1	27.0	45.3	13.4	86.9
I- 6	Nails	1.4	10.4	54.5	17.8	83.1	1.1	7.5	25.8	29.6	64.0
I- 7	Wood	.7	9.3	49.6	9.1	68.7	.6	11.8	34.5	16.6	63.6
II- 1	Inches in a foot	1.1	71.4	20.3	1.6	93.4	1.6	78.6	8.5	1.9	90.6
II- 2	Seconds in a minute	1.2	53.2	30.3	2.3	87.0	.9	61.8	19.3	1.9	83.9
II- 3	Cups of milk in a pint	1.6	25.0	17.6	20.8	65.0	1.1	26.2	20.3	20.4	68.0
II- 4	Cubic inches in a cubic foot	.4	11.8	.7	1.8	14.7	.2	9.1	1.3	1.9	12.5
II- 5	Acres in ½ Section	.0	2.8	1.9	2.1	6.8	.0	1.8	.5	1.3	3.6
II- 6	Pounds in a bushel of wheat	.2	3.0	4.2	8.7	16.1	.3	2.1	.2	6.7	9.3
II- 7	Pennyweight in an ounce	.0	.5	.0	1.8	2.3	.0	.9	.0	.8	1.7
II- 8	Dozen eggs in a crate	.2	.5	4.9	1.8	7.4	.0	.5	1.8	2.6	4.9
II- 9	Rods in a mile	.4	11.5	2.1	2.8	16.8	.6	9.1	.6	3.1	13.4
II- 10	Pecks in a bushel	1.6	36.3	9.9	5.9	53.7	.6	34.0	4.9	9.1	48.6
II- 11	Good average yield of cotton per acre	.0	.5	2.3	6.7	9.5	.0	.0	.3	4.1	4.4
II- 12	Good average yield of wheat per acre	.2	.4	4.9	11.3	16.8	.0	.2	1.3	10.9	11.4
III- 1	Height of dining-room table	.0	.0	.7	6.9	7.6	.2	.2	.2	7.0	7.6
III- 2	Height of living-room ceiling	.0	.5	12.5	32.6	45.6	.3	.8	4.9	28.6	34.6
III- 3	Width between rails of railroad	.2	.2	3.2	20.4	24.0	.0	.3	.8	9.3	10.4
III- 4	Glove size of average man	.5	.4	5.3	27.2	33.4	.9	.8	2.8	33.2	37.7
III- 5	Width of full size bed	.2	.0	1.4	4.1	5.7	.0	.0	.3	3.2	3.5

3. Sex Differences at Different Grade Levels

Despite slight variations the percentage of correct responses on each item of Sections I, II, and III is higher in the upper grades than the lower grades for both boys and girls. This is based on the third to the ninth grade, as was done in Chapter VII, since the second and tenth grades carry too small returns to be comparable to the other grades. These two grades are omitted from Tables XIII and XIV.

In Section I both boys and girls, even at the third grade level, show good comprehension as to the way in which the commodities of items I- 1, farmland, I- 2, potatoes, and I- 4, eggs are sold. The boys also show good comprehension at this same level on items I- 5, coal, and I- 6, nails. In the main, the trend on each item is quite a consecutively upward one from grade to grade. There are fluctuations on some items, as for instance I- 2, potatoes, there is a slight drop at the seventh grade level, while for item I- 6, nails, there is quite a percentage rise from the fifth to the sixth grade and then a slight decline from there onward. Other items show similar deviations.

Item II- 12, good average yield of wheat, is the only one of Section II which shows consecutive higher percentages at each grade level from the third to the ninth grade and even the tenth grade. The same is true for II- 5, acres in a quarter section, for the boys and II- 2, seconds in a minute, for the girls. Others, such as II-3, cups of milk in a pint, II-10, pecks in a bushel, and II-11, good average yield of cotton per acre, for the girls, II-6, pounds in a bushel of wheat, and II_8, dozen eggs in a crate, for the boys, and II-4, cubic inches in a cubic foot, for

Table XIII Shows the Percentage of Correct Answers for the Boys on the Items of Sections I, II and III at Each Grade Level for Five Selected States.

No. in grade	80	62	78	102	98	100	41
Grade	3	4	5	6	7	8	9
I- 1 Farmland	81.3	83.9	96.2	94.1	93.9	95.0	100.0
I- 2 Potatoes	83.7	93.5	94.9	98.0	96.9	97.0	100.0
I- 3 Cotton lint	23.7	19.3	28.2	28.4	28.6	34.0	31.7
I- 4 Eggs	85.0	95.2	98.7	96.1	97.9	99.0	100.0
I- 5 Coal	73.8	82.3	89.7	95.1	94.9	92.0	97.5
I- 6 Nails	65.0	72.6	87.2	85.3	88.8	93.0	95.1
I- 7 Wood	36.2	61.3	56.4	75.5	78.6	82.0	90.2
II- 1 Inches in a foot	88.7	88.7	94.9	96.1	93.9	99.0	100.0
II- 2 Seconds in a minute	60.0	61.3	92.3	96.1	95.9	98.0	100.0
II- 3 Cups of milk in a pint	58.7	54.8	62.8	73.5	63.3	69.0	68.3
II- 4 Cubic inches in a cubic foot	0.0	0.0	7.7	11.8	21.4	34.0	24.4
II- 5 Acres in $\frac{1}{4}$ section	0.0	0.0	3.8	3.9	6.1	11.0	29.3
II- 6 Pounds in a bushel of wheat	1.2	4.8	5.1	10.6	18.4	33.0	26.8
II- 7 Pennyweight in an ounce	0.0	0.0	6.4	2.9	2.0	3.0	0.0
II- 8 Dozen eggs in a crate	0.0	1.6	2.6	9.8	12.2	14.0	7.3
II- 9 Rods in a mile	2.5	6.4	7.7	16.7	23.5	32.0	26.8
II-10 Pecks in a bushel	12.5	37.1	56.4	64.7	64.3	65.0	70.7
II-11 Good average yield of cotton per acre	0.0	1.6	3.8	11.8	3.1	17.0	29.3
II-12 Good average yield of wheat per acre	0.0	1.6	5.1	13.7	24.5	35.0	36.6
III- 1 Height of dining-room table	2.5	1.6	1.3	9.8	16.3	7.0	7.3
III- 2 Height of living-room ceiling	5.0	14.5	33.3	42.1	68.4	74.0	78.0
III- 3 Width between rails of railroad	1.2	3.2	20.5	21.6	29.6	43.0	53.7
III- 4 Glove size of average man	12.5	14.5	11.5	22.5	46.9	59.0	63.4
III- 5 Width of full size bed	0.0	0.0	1.3	4.9	7.1	10.0	14.6

Table XIV Shows the Percentage of Correct Answers for Girls on the Items of Sections I, II, and III at Each Grade Level For Five Selected States.

No. in Grade		57	82	93	109	104	115	45
	Grade	3	4	5	6	7	8	9
I- 1	Farmland	61.4	82.9	91.4	97.2	96.2	95.6	95.6
I- 2	Potatoes	80.7	92.7	94.6	95.4	100.0	100.0	100.0
I- 3	Cotton lint	28.1	21.9	34.4	33.9	36.5	33.9	26.7
I- 4	Eggs	84.2	93.9	95.7	99.1	97.1	99.1	100.0
I- 5	Coal	49.1	84.1	90.3	90.0	92.3	95.7	93.3
I- 6	Nails	35.1	53.7	59.1	77.1	70.1	70.4	71.1
I- 7	Nails	35.1	43.9	55.9	65.1	75.9	79.1	82.2
II- 1	Inches in a foot	78.9	76.8	90.3	93.6	97.1	97.4	97.8
II- 2	Seconds in a minute	43.9	67.1	76.3	90.8	88.1	98.1	100.0
II- 3	Cups of milk in a pint	47.4	58.5	66.7	71.6	75.0	78.3	68.9
II- 4	Cubic inches in a cubic foot	0.0	1.2	8.6	14.7	20.2	22.6	8.9
II- 5	Acres in $\frac{1}{4}$ Section	0.0	0.0	1.1	3.7	2.9	6.9	8.9
II- 6	Pounds in a bushel of wheat	5.3	2.4	9.7	4.6	10.6	16.5	15.6
II- 7	Pennyweight in an ounce	0.0	1.2	2.1	1.8	3.9	.8	2.2
II- 8	Dozen eggs in a crate	1.7	3.7	5.4	2.7	3.9	7.8	11.1
II- 9	Rods in a mile	0.0	10.9	4.3	17.4	20.2	18.3	20.0
II-10	Pecks in a bushel	10.5	34.1	45.2	58.7	61.5	65.2	40.0
II-11	Good average yield of cotton per acre	0.0	2.4	4.3	5.5	7.7	9.6	2.2
II-12	Good average yield of wheat per acre	0.0	1.2	6.4	14.7	18.2	19.1	24.4
III- 1	Height of dining-room table	1.7	7.3	4.3	7.3	10.6	8.7	13.3
III- 2	Height of living-room ceiling	8.8	10.9	26.9	37.6	42.3	48.7	62.2
III- 3	Width between rails of railroad	0.0	3.7	10.7	10.1	9.6	15.6	24.4
III- 4	Glove size of average man	12.3	14.6	30.1	36.7	48.1	53.0	64.4
III- 5	Width of full size bed	0.0	0.0	2.1	1.8	3.9	7.8	11.1

both boys and girls show a drop in the percentage of correct responses for the ninth grade. As pointed out in Chapter VII this may be due to the fact that there are considerably less pupils in this grade as compared to grades three to eight.

With but very few fluctuations, Section III shows quite a steady increase in the percentage of correct responses from one grade level to the other for both boys and girls. Item III- 1, height of dining-room table, for the boys shows a rapid rise at the seventh grade with a decrease from there on to the ninth grade. The same item for the girls shows a rise in the percentage of correct responses at the fourth and seventh grade levels. Item III- 3, width between rails of railroad, for the girls shows a drop in the percentage of correct responses at the seventh grade, while III-4, glove size of average man, for the boys shows a drop at the fifth grade level. For the girls items III- 2, height of living-room ceiling, III- 4, glove size of average man, and III- 5, width of full size bed, except for a drop of .3 percent drop at the sixth grade, are consecutively higher at each grade level. Items III- 2, height of living-room ceiling, III- 3, width between rails of railroad, and III- 5, width of full size bed, for the boys are consecutively higher at each grade level.

In spite of the slight variations already noted, the trend from grade to grade for each item is an upward one for both the boys and girls. Tables XIII and XIV show the percentages to run about the same for both boys and girls, except on items I- 5, coal, I- 6, nails, I- 7, wood, II- 6, pounds in a bushel of wheat, II- 11, good average

yield of cotton per acre, II- 12, good average yield of wheat per acre, III- 2, height of living-room ceiling, and III- 3, width between rails of railroad. For these the percentages tend to run higher for the boys.

4. Significance of Percentage Differences between the Sexes

Table XV serves as a basis for the material presented in this section. Column two shows the percentage of correct responses for the boys with city and rural combined while column four shows the same for the girls. Columns three and five give the probable error (P.E.) for these percents, while column six shows the percentage differences between the two percents with the probable error (P.E.) for each.

In Section I items I- 5, coal, and I- 6, nails, show statistical percentage differences in favor of the boys. The percentage for nails, 17.0 ± .76, is much greater than the percent of 5.8 ± P.E. .50 for coal. This difference is very obvious as shown in Figure 16. The percentage differences for items I- 1, farmland, I- 2, potatoes, I- 3, cotton lint, and I- 4, eggs, are negligible. Item I- 7 wood, shows a percentage difference of 3.6 ± P.E. .74. This is .1 percent of a point less than its probable error. The difference is not a significant one.

Five items of Section II show statistical percentage differences in favor of the boys. II- 1, inches in a foot, shows a percentage difference of 3.5 ± P.E. .46, while II- 5, acres in a quarter section, shows a percentage difference of 4.1 ± P.E. 4.5. The percentage difference

for II- 6, pounds in a bushel of wheat, is 7.4 ± P.E. .54, while that for II- 12, good average yield of wheat per acre, is 4.3 P.E. ±.37 Items II- 5, (acres in a quarter section), II- 6 (pounds in a bushel of wheat, and II- 12 (Good average yield of wheat per acre) are ten times their probable error, while items II- 1 (inches in a foot) and II- 11 (good average cotton per acre) are only slightly greater than five times their probable error. All of these items, except II- 1, inches in a foot, are ones in which boys are naturally more interested than girls and may account for these differences. The percentage differences for items II- 7, pennyweight in an ounce, and II- 8, dozen eggs in a crate, are negligible. For the remaining seven items the percentages for the boys are slightly higher than those for the girls but these differences are not great enough to be statistically significent as shown in Table XV and Figure 16.

In Section III the percentages for each item are greater for the boys than for the girls. Three of these, III- 1, height of a dining-room table, III- 4, glove size of an average man, and III- 5, width of a full size bed, carry percentage differences which are statistically negligible as shown in Table XV. Item III- 2, height of living-room ceiling, shows a percentage difference of 9.8 ±P.E. .79 which is better than ten times its probable error. The percentage difference of 13.8 ± P.E. .65 for III- 3, width between rails of railroad, is better than twenty times its probable error. These are both statistically significant in favor of the boys. There was no information on the questionnaire as to either the father's occupation or work done by the boys which would aid in determining a reason for the difference. Since railroads hold an attraction to

Table XV Shows the Probable Error (P.E.) of the Percentage of Correct answers for Boys and Girls and the Probable Error (P.E.) of the Percentage Differences on all the Items in Sections I, II, and III for the 43 States and District of Columbia.

		Boys (3174)		Girls (3399)			
		Percent	P.E.	Percent	P.E.	Percentage Difference	P. E. of Percentage Difference
I- 1	Farmland	92.1	± .32	91.1	± .33	1.0	± .46
I- 2	Potatoes	94.6	± .27	94.3	± .26	.3	± .37
I- 3	Cotton lint	27.5	± .47	27.6	± .51	.1	± .69
I- 4	Eggs	96.7	± .23	94.8	± .25	.9	± .34
I- 5	Coal	86.4	± .40	80.6	± .31	5.8	± .50
I- 6	Nails	75.9	± .51	58.9	± .57	17.0	± .76
I- 7	Wood	63.0	± .47	59.4	± .57	3.6	± .74
II- 1	Inches in a foot	92.6	± .31	89.1	± .34	3.5	± .46
II- 2	Seconds in a minute	87.7	± .39	85.7	± .40	2.0	± .56
II- 3	Cups of milk in pint	71.6	± .54	69.4	± .53	2.2	± .74
II- 4	Cubic inches in a cubic foot	17.6	± .45	15.1	± .40	2.5	± .60
II- 5	Acres in $\frac{1}{4}$ Section	10.4	± .36	6.3	± .27	4.1	± .45
II- 6	Pounds in a bushel of wheat	16.3	± .44	8.9	± .32	7.4	± .54
II- 7	Pennyweight in an ounce	3.8	± .24	3.6	± .20	.2	± .31
II- 8	Dozen eggs in crate	6.9	± .44	6.2	± .27	.7	± .51
II- 9	Rods in a mile	15.5	± .43	13.1	± .39	2.4	± .48
II-10	Pecks in a bushel	59.9	± .58	56.8	± .57	3.1	± .81
II-11	Good average yield of cotton per acre	5.8	± .25	3.6	± .20	2.1	± .32
II-12	Good average yield of wheat per acre	12.9	± .40	8.6	± .32	4.3	± .37
III- 1	Height of dining-room table	8.6	± .34	8.2	± .31	.4	± .46
III- 2	Height of living-room ceiling	43.2	± .58	33.4	± .54	9.8	± .79
III- 3	Width between rails of railroad	26.6	± .53	12.8	± .38	13.8	± .65
III- 4	Glove size of average man	32.6	± .56	31.7	± .53	.9	± .77
III- 5	Width of full size bed	5.7	± .27	5.4	± .26	.3	± .33

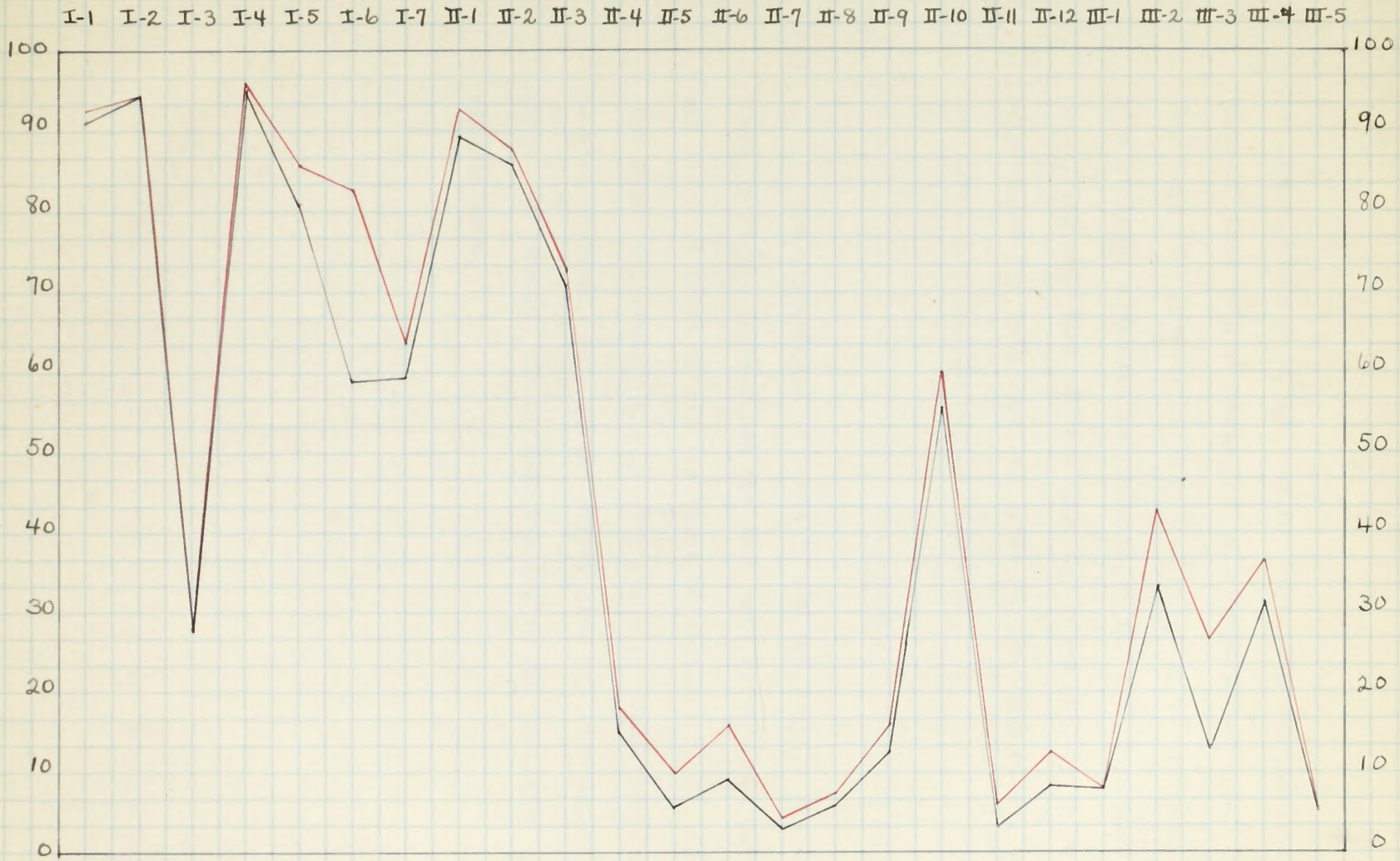

Fig. 16 Showing Graphically the Percentage of Correct Responses on Sections I, II, and III for Boys and Girls, City and Rural Combined, for the 43 States and District of Columbia

— Boys — Girls

most boys, it is possible that the boys have had more contact with them and that this accounts for this great difference. It is apparent that boys show greater ability than do girls in estimating the height of a ceiling, although the percentages for both boys and girls, being small, indicate that neither show any great ability to do so. The percentages for both boys and girls on the items of all three sections are shown in a graphic way in Figure 16.

Summary

The percentages in Table XV and the graphic presentation of these in Figure 16 bear out the fact that differences between boys and girls do exist on all the items of Sections I, II, and III. That these differences are greater for some items than for others is also obvious. Some of the differences are statistically significant. In general, the differences are in the direction of reasonable expectations.

CHAPTER IX

Tables of Measures

Section IV of the questionnaire seeks to answer the question, "Are you taught the tables of measures as tables?" The responses in this section fall into 3 categories, blank, yes and no. A blank means that neither the "Yes" nor "No" on the questionnaire was underlined. If the "Yes" was underlined the response was recorded "Yes." The same is true for "No." The boys and girls in city and rural schools were tabulated separately.

Comparison of Responses for Boys and Girls in City and Rural

Table XVI shows the percentage of boys and girls in city and rural sections who answered "Blank," "Yes" or "No." It will be seen from columns two and eight that 15.2 percent of the boys of the city against 13.4 percent of the rural gave no answer. In the same column 48.4 percent of the boys of the city answered "Yes" against 46.7 percent in the rural. This means a percentage difference of 1.7 ± P.E. 1.5 which is not a significant difference. For the answer "No" the opposite is true, with 36.4 percent of the city boys answering "No" against 39.9 percent for the rural, or a percentage difference of 3.5 ± P.E. 1.2, which is not significant. The data for the girls tells practically the same story. 15.2 percent of the girls in the city gave no answer as compared to 13.2 percent for the rural or a difference of 2.0 percent. The girls in the city and rural answered practically the same for "Yes" with 51.4 and 51.0 percents respectively, or a non-significant difference of .4 ± P.E. 1.2. For the answer "No"

Table XVI Shows the Percentage of Boys and Girls for the 43 States and District of Columbia, City and Rural, who Answered "Blank", "Yes", and "No" on Section IV--Table of Measures Taught as Tables.

	City						Rural					
	Boys		Girls		Boys and Girls		Boys		Girls		Boys and Girls	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Blank	299	15.2	347	15.2	646	15.2	162	13.4	148	13.2	310	13.3
Yes	953	48.4	1170	51.4	2123	50.0	563	46.7	572	51.0	1135	48.8
No	717	36.4	760	33.4	1477	34.8	480	39.9	402	35.8	882	37.9
Total	1969	100.0	2277	100.0	4246	100.0	1205	100.0	1122	100.0	2327	100.0

| | | |

33.4 percent of the city girls and 35.8 percent of the rural girls answered thus. Here again the difference of 2.4 ± P.E. .76 is not significant. Figure 17 shows the above data in graphic form.

The fact that the percentage differences for boys and girls in city and rural districts are negligible indicates the reliability of the responses on the first 3 sections of the questionnaire. More convincing evidence is possible from the comparison of the responses of boys and girls within one school system. Such data are here presented for the school at Takoma Park, District of Columbia. If there were any evidences of unreliability there would be every opportunity for it here.

	Boys (64)			Girls (68)		
	Blank	Yes	No	Blank	Yes	No
Number	4	18	42	0	20	48
Percent	6.3	28.1	65.6	0	29.4	70.6

The percentage difference between 28.1 percent of "Yes" responses for the boys and 29.4 percent of "Yes" responses for the girls is 1.3 ± P.E. 7.8. The percentage difference between 65.6 percent of "No" responses for the boys and 70.6 percent for the girls is 5.0 ± P.E. 8.1. Neither of the percentage differences are statistically significant.

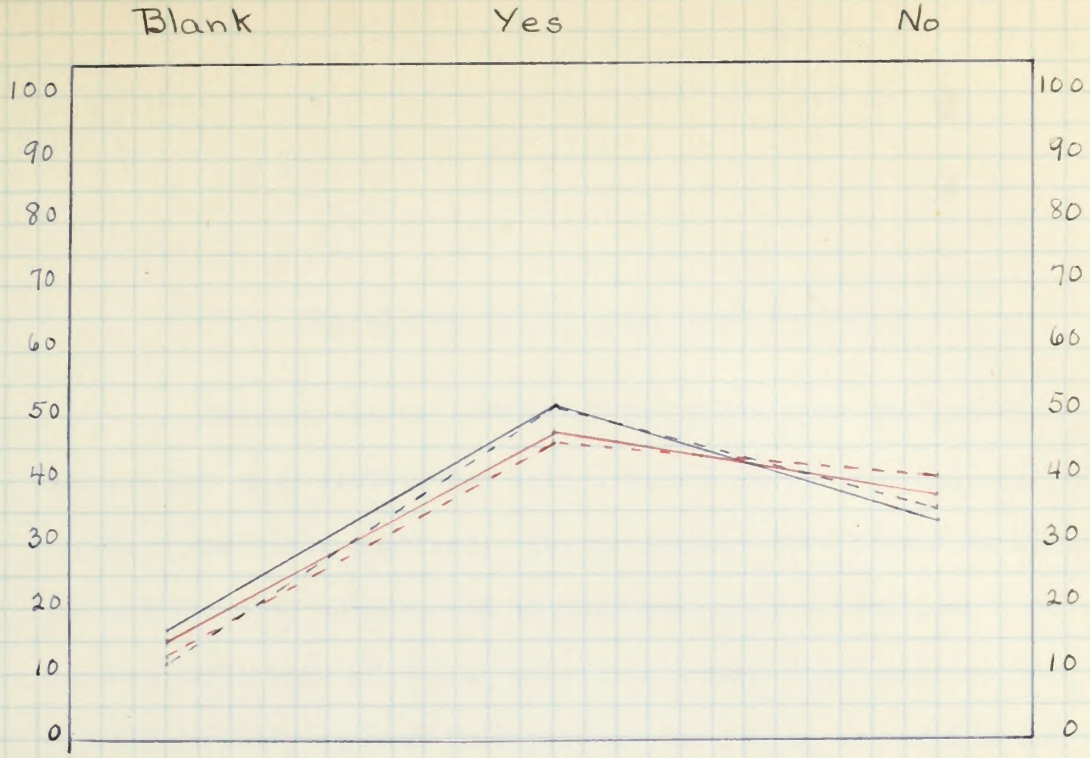

Fig. 17 Showing Graphically the Percentage of Answers on Section IV for Boys and Girls, City and Rural, for the 43 States and District of Columbia

Boys — City
---- Rural

Girls — City
---- Rural

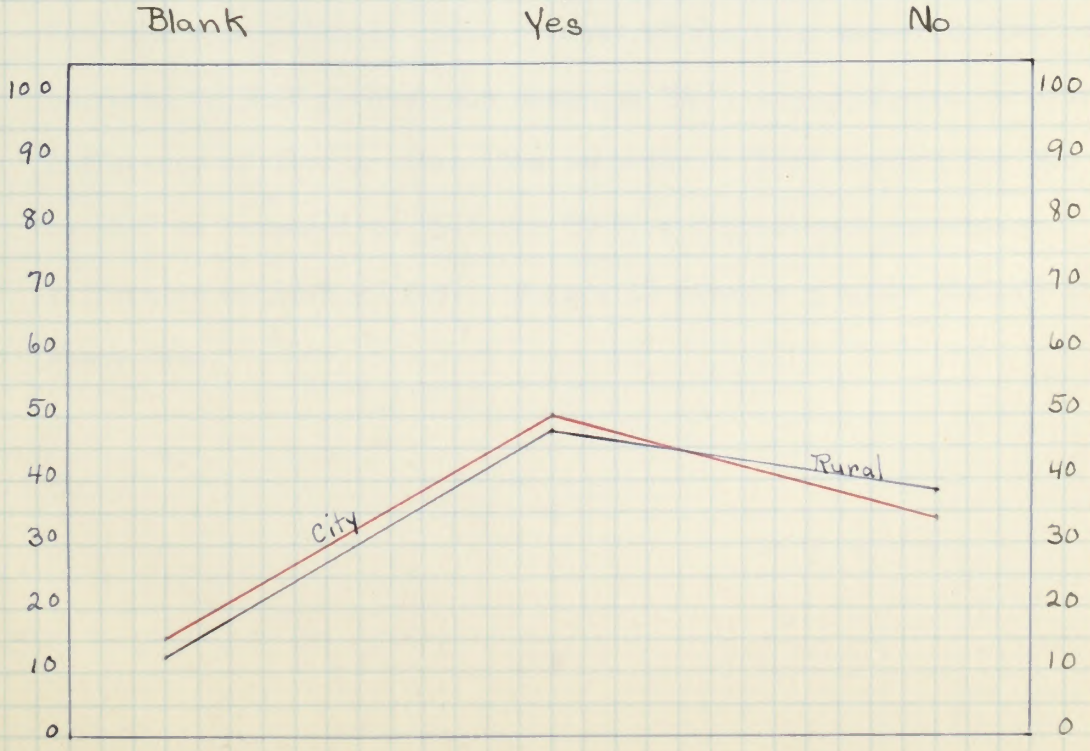

Fig. 18 Showing Graphically the Percentage of Answers on Section IV, Boys and Girls Combined, City and Rural, for the 43 States and District of Columbia

Comparison of City and Rural Responses

Columns six and twelve of Table XVI show the percentage of answers for each section for both city and rural with the responses for boys and girls combined. The percentage for "Blank" is 15.2 percent for city as compared to 13.3 percent for rural, or a percentage difference of 1.9 ± .80. The answer "Yes" carries 50.0 percent for city against 48.8 percent for rural, or a difference of 1.2 ± .67. The percentage for answer "No" for city and rural is 34.8 and 37.9 percent respectively. The percentage difference here is 2.9 ± .83. All of these percentage differences are negligible. A comparison of the percentage of "Yes" and "No" answers may be made from the same columns. 50.0 percent of the city answered "Yes" as compared to 34.8 percent who answered "No", a significant percentage difference of 11.2 ± 1.1. The percent of "Yes" answers for the rural is 48.8 as compared to 35.8 for "No", a significant percentage difference of 10.9 ± 1.5. Figure 18 shows a graphic picture of these data.

Table XVII Shows the Percentage of Answers for "Blank", "Yes" and "No" on Section IV, City and Rural, for Each of the 43 States and District of Columbia.

	City			Rural		
	----	Yes	No	----	Yes	No
Ala.	15.4	53.8	30.8	37.5	54.2	8.3
Arizona	19.0	52.4	28.6	13.6	64.4	22.0
Ark.	11.1	88.9	0.0	----	----	----
Calif.	15.7	38.8	45.5	13.3	42.1	44.6
Colo.	9.1	62.4	28.5	12.4	41.2	46.4
Conn.	24.2	66.7	9.1	----	----	----
D.C.	3.0	28.8	68.2	----	----	----
Fla.	15.5	48.7	35.8	15.0	75.0	10.0
Ga.	17.8	60.0	22.2	25.0	0.0	75.0
Idaho	19.2	61.6	19.2	----	----	----
Ill.	6.6	52.1	41.3	10.2	51.9	37.9
Ind.	14.6	49.6	35.8	5.9	29.4	64.7
Iowa	7.9	65.1	27.0	8.4	45.8	45.8
Kan.	19.4	70.9	9.7	38.5	38.5	23.0
Ken.	25.9	44.5	29.6	0.0	66.7	33.3
La.	37.5	50.0	12.5	----	----	----
Me.	6.3	62.5	31.2	0.0	85.7	14.3
Md.	16.7	58.3	25.0	----	----	----
Mass.	10.1	66.4	23.5	16.4	34.4	49.2
Mich.	22.3	50.4	27.3	20.9	36.7	42.4
Minn.	10.9	42.7	46.4	21.9	50.0	28.1
Miss.	0.0	0.0	100.0	----	----	----
Mo.	16.7	60.4	22.9	2.0	74.0	24.0
Mont.	14.7	55.9	29.4	11.1	66.7	22.2
Neb.	3.0	36.4	60.6	11.8	39.7	48.5
N. H.	----	----	----	10.0	50.0	40.0
N. M.	0.0	57.1	42.9	35.3	55.9	8.8
N. Y.	9.9	64.5	25.6	0.0	50.0	50.0
N. Car.	25.9	37.0	37.1	9.1	36.4	54.5
N. Dak.	----	----	----	18.2	54.5	27.3

Table XVII, continued.

	City			Rural		
	----	Yes	No	--	Yes	No
Ohio	0.0	81.1	18.9	5.4	49.2	45.4
Okla.	21.9	40.9	37.2	22.2	55.6	22.2
Ore.	20.2	48.2	31.6	12.3	63.8	23.9
Pa.	17.8	56.8	25.4	20.0	70.0	10.0
R. I.	16.7	50.0	33.3	----	----	----
S. Car.	0.0	0.0	100.0	----	----	----
S. Dak.	12.0	64.0	24.0	33.3	50.0	16.7
Tenn.	22.1	47.7	30.2	17.2	48.4	34.4
Texas	9.1	50.0	40.9	17.6	54.6	27.8
Va.	6.8	50.0	43.2	15.6	64.9	19.5
Wash.	9.2	61.5	29.3	6.6	46.2	47.2
W. Va.	15.2	51.5	33.3	----	----	----
Wis.	35.6	18.6	45.8	14.4	45.8	39.8
Wy.	0.0	50.0	50.0	7.7	76.9	15.4

Table XVII shows the analysis of the data more in detail. The percentage of answers for each, "Blank", "Yes" and "No", are given for both city and rural. Upon close study of the table it is seen from the data for the city that 33 of the 41 states and District of Columbia carry a higher percentage of "Yes" than "No" answers, while 7 of the remaining 9 states namely, California, District of Columbia, Minnesota, Mississippi, Nebraska, South Carolina and Wisconsin carry a higher percentage of "No" responses. These do not represent any one section of the country. The fact that South Carolina and Mississippi appear with this group may be due to the small number of returns from each, with four and six respectively. Two of the states, Wyoming and North Carolina, carry the same percentage foreach the "Yes" and "No." The range of percents for the states yielding city returns, answering "Yes" is from 88.9 percent for Arkansas to 40.9 percent for Oklahoma. The range of percents for those answering "No" is from 100.0 percent for Mississippi and South Carolina to 0.0 percent for Arkansas.

The same table shows that, of the 34 states yielding rural returns, 23 states carry a higher percentage of "Yes" than "No" answers, while 10 of the remaining 12 states namely, California, Colorado, Georgia, Indiana, Massachusetts, Michigan, Nebraska, North Carolina and Washington carry a higher percentage of "No" than "Yes" answers. These states represent different sections of the country. The range of percents for the states yielding rural returns, answering "Yes" is from 85.7 percent for Maine to 38.5 percent for Kansas. The range of percents for those answering "No" is from 75.0 percent for Georgia to 42.4

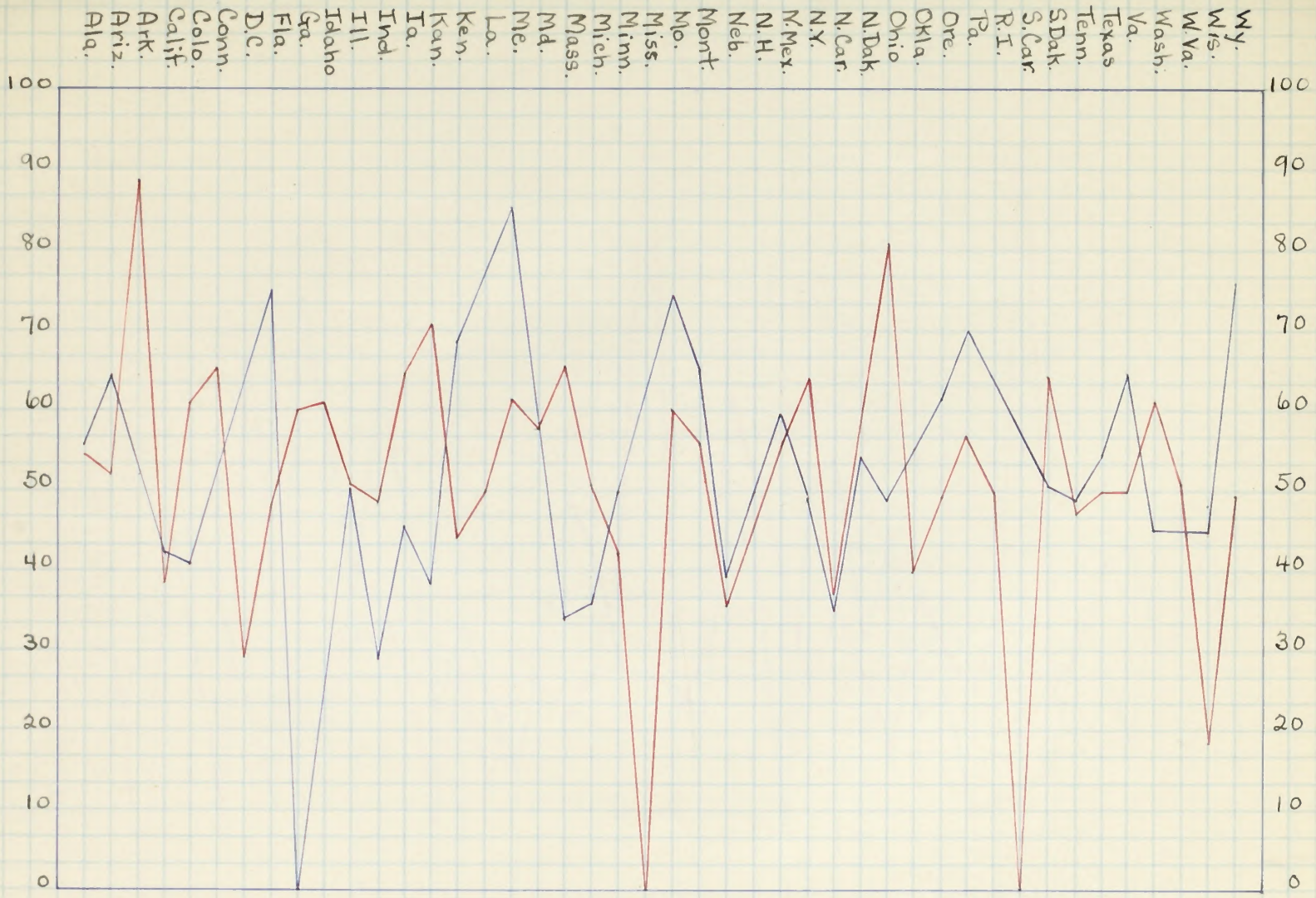

Fig. 19 Showing Graphically the Percentage of "Yes" Answers on Section IV, Tables of Measures, City and Rural, for the 43 States and District of Columbia

— City — Rural

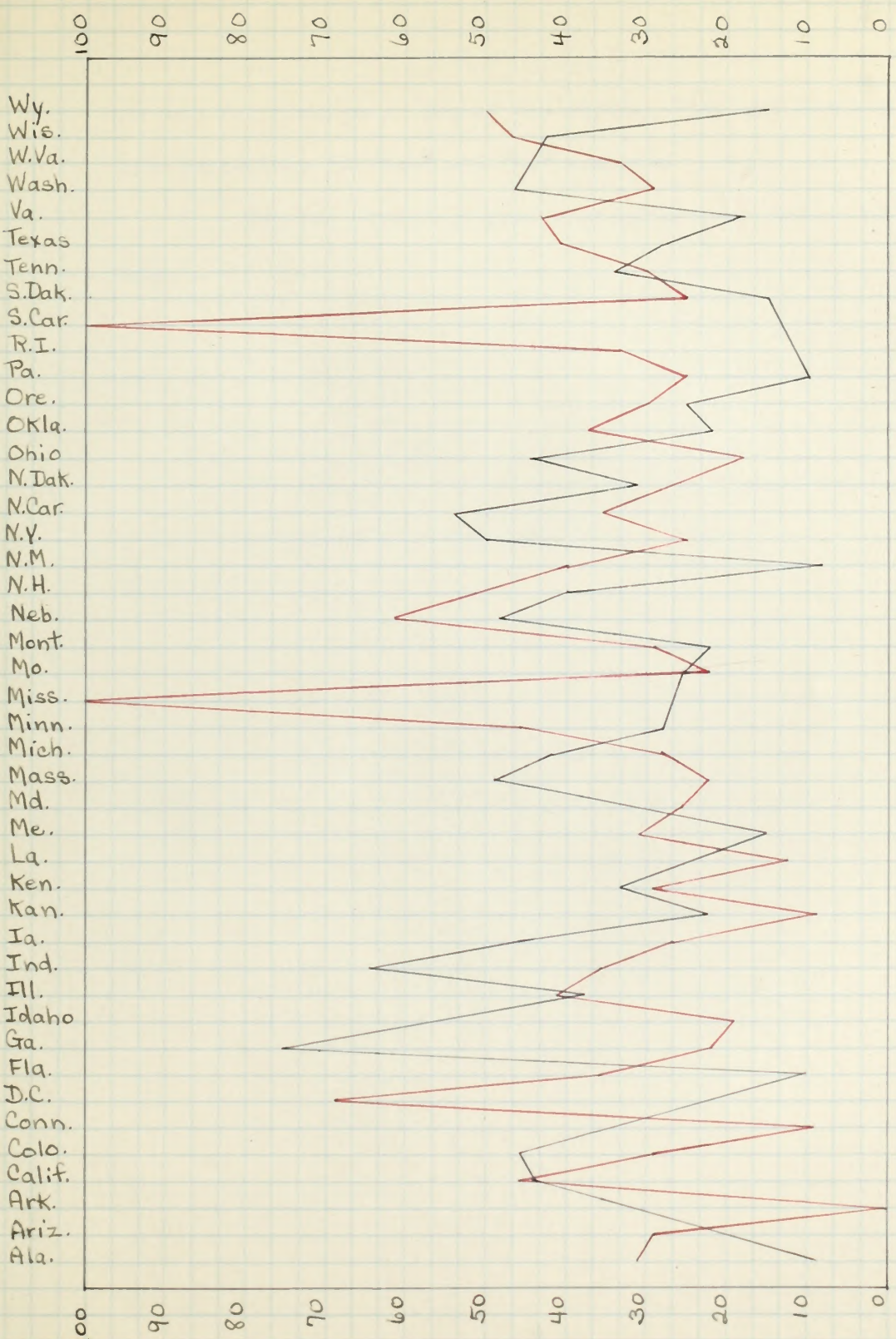

Fig. 20 Showing Graphically the Percentage of "No" Answers on Section IV, Tables of Measures, City and Rural, for the 43 States and District of Columbia

percent for Michigan. Two of the states, Iowa and Wyoming, carry the same percentage of "Yes" and "No" answers.

Figures 19 and 20 show a graphic presentation of the above data.

CHAPTER X

SUMMARY AND CONCLUSIONS

Limitations of the Study

It is recognized that this investigation has certain limitations. As pointed out in Chapter II, the questionnaire procedure carries with it elements of unreliability, but it is the best possible procedure for gathering data from a wide area. Evidences of not too great unreliability are found in the statistics of the "Yes" and "No" responses between boys and girls within one school system and the country at large as indicated in Chapter IX.

Specifically from this Study

This study has attempted to ascertain, through sampling with typical or key measures or opportunities to use measures, the nature of measures known or not known and the reasons for such knowledge or its absence for children in all sections of the country. Detailed data have been presented and analyzed in the preceding chapters. In summarizing these data in the form of conclusions, chief reliance is placed upon the tables and figures found in Chapters IV to IX. Answers to questions in Chapter I will follow in the same order in which they are presented. Careful study of the data seems to justify the following conclusions:

1. Children, even in the earlier grades, have a knowledge of the measures and denominate numbers employed in purchasing the most common commodities used by the family. For example; third grade children show 84.6 percent correct answers on how eggs are sold, 82.4 percent for potatoes, and 63.5 percent for coal. See Table VIII.

2. Experience is a vital factor in the knowledge possessed by children in the purchasing of the most common commodities as shown by Table VI. In Section I number "2" (experience) carries the highest percentage of correct responses for each item with the exception of I-3, cotton lint. Among the rural children all six items show statistically significant percentage differences in favor of number "2" (experience), while in the city four of the six items, I-2, potatoes, I-4, eggs, I-5, coal, and I-7, wood, show significant percentage differences in favor of number "2" (experience). Items I-1, farmland, and I-6, nails, show higher percentages for number "2" (experience) than either number "1" (school) or number "3" (a guess) although they are not statistically significant differences.

Even though the "fair estimate" responses for all the items of Section III carry higher percentages for number "3" (a guess), yet for item III-3, width between the rails of a railroad, experience is the basis for the responses indicated by the three children who gave the exact measurement of 4 feet $8\frac{1}{2}$ inches. (Chapter IV) Item II-8, dozen eggs in a crate, of Section II for the rural shows a higher percentage of correct responses indicated by number "2" (experience). Of those who gave the correct response, 30, more than half of them had an experience background in farming, poultry raising, grocery business, etc. .

3. School appears to be another basis for the possession of knowledge of certain measures as shown in items 1 to 5 and 9 and 10 of Section II since number "1" (school) carries the highest

percentage of correct responses on these items. These are measures commonly found in the textbooks and taught in the schools. Of these seven items, Table IV (Chapter V) shows five of them to possess differences in both city and rural which are statistically significant in favor of number "1" (school). These are items II-1, inches in a foot, II-2, seconds in a minute, II-4, cubic inches in a cubic foot, II-9, rods in a mile, and II-10, pecks in a bushel. Aside from items II-1, and II-2 the percentage of correct responses are small.

4. It appears that when real assurance of the correct response is lacking a guess is made, for the remaining five items of Section II carry higher percentages for number "3" (a guess) with but two exceptions. These are II-7, pennyweight in an ounce, for the city in which number "1" (school) leads and II-8, dozen eggs in a crate, for rural, in which number "2" (experience) leads. Only three of the five items show statistical significant differences in favor of number "3". These are II-6, pounds in a bushel of wheat, and II-12, good average yield of wheat per acre, for both city and rural and item II-11, good average yield of cotton per acre, for the city. All the items of Section III, except III-5, width of full size bed, for city show percentages in favor of number "3" which are statistically significant.

5. Some measures are better known in one section of the country than in others. For instance on item II-11, good average yield of cotton per acre, the states in which cotton is grown carry

higher percentage of correct responses than those in which it is not grown. Item II-12, good average yield of wheat per acre, shows the same to be true for the states in which wheat is grown. In spite of the fact that number "3" tends to lead on these items, it is apparent that experience is a vital factor since the states in which the commodity is grown show better returns than those in which it is not grown. Doubtless "3" (a guess) was written when the individual was not quite certain. Item I-2, potatoes, also shows a variation in the measures used when making purchases. As pointed out in Chapter IV the southern and western sections of the country gave pound as the most common answer, while the eastern, middle west, and a few southern states gave peck or bushel as the most common answer.

6. Many of the measures used in this study are commonly taught in the schools. Despite this fact the ability to apply these measures in estimating distances and heights in Section III is not pronounced with these children. For example, the foot measure used in estimating the height of a ceiling. It is obvious that many had no concept of its application when such answers as 75, 100 and 180 feet were given. (Appendix B). The percentages of "fair estimate" responses are small for all the items of this section as shown in Chapter V. This is especially true of items III-1, height of a dining-room table, and III-5, width of a full size bed.

7. The percentage of correct responses for city and rural, as shown in Table IV, Chapter V, seems to indicate that a difference in the knowledge of measures and denominate numbers between the two is negligible. Only six of the twenty-four items of Sections I, II, and

III show statistically significant percentage differences. These are I-3, cotton lint, I-4, eggs, I-7, wood, II-2, seconds in a minute, II-6, pounds in a bushel of wheat, and II-8, dozen eggs in a crate. All of these are favorable to the rural except I-4, eggs, and II-2, seconds in a minute. None of them, though statistically significant, show wide percentage differences, the greatest being 5.9 percent ± P.E. .62 for II-2, seconds in a minute. The percentages for items I-3, cotton lint, II-6, pounds in a bushel of wheat, and II-8, dozen eggs in a crate, are small, while those for items I-7, wood, and II-2, seconds in a minute, are not.

8. There is a difference in a knowledge of the measures known and the ability to estimate measures on the part of boys and girls. Each item of Sections I, II, and III, except I-3, cotton lint, shows a percentage difference in favor of the boys as indicated in Table XV. Not all are significant differences. Sixteen items, or two-thirds of them, show differences that are negligible. Of the eight items that show significant differences only two of them carry high percentage differences. These are I-6, nails, and III-3, width between rails of a railroad. It is not surprising that the boys do better on these, for the very nature of the items indicate that they would come more into their experiences. Doubtless this accounts for the great percentage difference of 17.0 ± P.E. .78. Boys are more often attracted to railroads and without doubt this contact accounts for the wide percentage difference of 13.8 ± P.E. .65 on item III-3, width between rails of railroad.

9. Maturity is a factor in the knowledge possessed by boys and girls relative to measures and ability to estimate measures. While there is indication of variance on a few of the items, yet in general the trend is toward consecutively higher percentage of correct responses from one grade level to the next. This is quite obvious from Table VIII and Figures 10, 11, and 12 of Chapter VII. At the ninth and tenth grade levels items I-2, potatoes, and I-4, eggs, show perfect responses, while items I-1, farmland, at the tenth grade level and II-2, seconds in a minute, at the ninth grade level show perfect responses. At the seventh and eighth grade levels some items show almost perfect responses.

10. The practice of teaching the tables of measures as tables still persists in the schools. Most of the states carrying higher percentage of "No" responses are states which carry on a progressive educational program as indicated in Table XVII. Comparing the percentage of "Yes" and "No" responses for the boys in the city to those of the rural, as shown in Chapter IX, the differences are negligible. The same is true in case of city and rural girls. "Yes" also carries the highest percentage of responses in both city and rural with boys and girls combined with a statistically significant percentage difference between "Yes" and "No" of 11.2 ± P.E. 1.1 for the city and 10.9 ± P.E. 1.5 for the rural. This is obvious from Figure 18.

Implications from the Study

What bearing does this study have on arithmetic reconstruction in the field of denominate numbers and measures? The data reveals informations which aid very materially in setting forth a basis for the teaching of the same in the schools. It is the purpose of this section to note these implications based upon the facts presented in the preceding chapters. They are:

1. That certain measures are used more commonly in one section of the country than in others would indicate that teaching should tie up closely with local practice. For instance: in the western states the pound is used more commonly than either peck or bushel in the purchasing of potatoes. This would seem to indicate that the teaching in the schools should be in keeping with local practices. The same would hold true with peck and bushel in the sections in which they are used more commonly.

2. Though the percentages of correct responses are small for such commonly taught measures in school as II-4, cubic inches in a cubic foot, II-5, acres in a quarter section, II-6, pounds in a bushel of wheat, II-7, pennyweight in an ounce, and II-9, rods in a mile, there seems to be no justifiable reason for continued drill on them. They are encyclopedic facts, for reference only. See. Table I, page 43 It is apparent that they are not functional or the retention of the same would be greater. The percentages are small. A glance at Table VIII page (100) shows that even at the junior-high school level the percentages for these items are small. This would indicate that even at this level they are not functional. The implication is that any teaching of these measures will be incidental in connection with worthwhile usage.

3. How significant are the differences that exist between the knowledge possessed by boys and girls on the various items? Do they warrant the use of separate text-books for boys and girls? The answer is unquestionably "NO". Of the 24 items, only two show statistically significant differences. These are I-1, nails, and III-3, width between the rails of a railroad. As previously pointed out, experiences are doubtless the basis for such differences. In keeping with this fact it is definitely recommended that teaching at the different grade levels tie up closely with local conditions.

4. The study definitely indicates no significant differences in rural and city districts. This implies that the content and teaching of the most common measures be essentially the same in either rural or city localities. The aim should be extension of usage as a basis of understanding, not memorization of tables and facts.

5. Greater teaching emphasis could well be given to the ability to estimate heights, distance, width, etc. since this is very frequently needed and an ability in which these children show great deficiency. See Table IV, chapter V. It is recommended that what teaching is done along this line be practical. Let children estimate and measure objects about them rather than follow textbook procedures which may be entirely foreign to their experiences and needs.

6. Apparently much of what is being taught in the schools is not functional and could well be eliminated as drill. The program could be greatly simplified. Experience is a vital factor. See Table VI.

In General, in Combination with Other Studies

The purpose of this section is to note the findings of this investigation in their relation to studies of a similar nature. Peter's study[1] has indicated the possibility of such a procedure here since there is a certain amount of carry over from one study to the other. The intent in this section is to avoid statistics as such. Evidence has been gone over carefully in previous chapters and conclusions drawn therefrom. The aim here is to indicate implications with possible applications, bringing together in non-statistical form that which the lay reader will want and understand.

This is a fifth study in the field of Measures and Denominate Numbers conducted at Boston University for the purpose of ascertaining what is essential or useful for arithmetic teaching in the grades. Traniello[2], Louth[3], and Sala[4] found by a study of business that most of the work in measures and denominate numbers in the schools finds no place in business. Dorothy Wilson[5] found that experience is a chief factor in determining what children and adults know. This study extends the Dorothy Wilson study to a size sufficient to justify conclusions. Since there is no essential conflict among the five studies, it seems that their evident conclusions and implications are established beyond a reasonable doubt. The conclusions that follow from the five combined studies are obviously approximately as follows:

1. Experience is the factor that makes a difference. Children

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1. Peters, op. cit.
2. Traniello, op. cit.
3. Louth, op. cit.
4. Sala, op. cit.
5. Wilson, D., op. cit.

and adults tend to respond better on items with which they have had experience and to forget anything not used in experience. From the standpoint of teaching this means that emphasis should be placed on experience rather than textbook procedures. To illustrate: the meaning of a mile is developed, if at all, through such experiences as the distance a child travels between two places, perhaps in terms of a certain number of city blocks or the distance his home is from the school, etc. The writer's own concept of a mile is traceable to a childhood experience. The distance between her home and that of her grandparents was exactly one mile. This mile distance was traveled numerous times on foot, on bicycle, and with horse and carriage until it became firmly fixed in mind. The concept of that mile still lingers and is always the basis for estimating any distance. Teachers would do well to capitalize similar experiences of children, making them the basis for the establishment of greater measurement ability.

2. Despite the tendency of the schools to teach tables of measures as tables, the carry over or application of such to distances and heights is quite definitely lacking as shown in the Dorothy Wilson study and the present investigation. Traniello, Louth, and Sala showed that a table of measure is seldom or never used in its entirety in business. In fact any commodity is bought or sold in one unit, unless the description is a double description such as length and size of a pipe, one yard of $\frac{1}{2}$ inch ribbon, etc. The teaching of tables of measures as such is not necessary or worthwhile. Doubtless a better procedure would be to teach each unit in its natural setting or in relation to some situation or experience.

3. The same commodity may be sold in different units in one section of the country as compared to another. For instance potatoes are more commonly sold and purchased on the pound basis in the west as compared to peck and bushel in the East or Middle West. Again the same commodity may be bought or sold in different units in the same locality. Potatoes may be sold by the bushel, peck, or even barrel or eggs may be sold by the dozen or pound. The implication here is that teaching in the schools should tie up closely with the life of the child in the community. It should rely on the common practices rather than formal teaching from the textbook.

4. Most of the teaching of weights and measures has been ineffective. The percentages of successful answers are exceedingly low. Clear concepts are lacking. If the work in the schools had been omitted the results apparently could have been little different. Such work as the committing of the tables of measures, reductions ascending and descending and compound denominate numbers have little, if any, place in business and may very profitably be eliminated from the school program.

5. If the school is to train the future citizens of tomorrow then curriculum builders must give heed to that which contributes to the highest development of the boy or girl. The findings of research cannot be overlooked. The school would do well to place greater teaching emphasis on such commonly used measures as inch, pound, and foot and the application of these to life, the lack of which is all too obvious. This conclusion is reinforced by the studies of Traniello, Sala, Louth and Dorothy Wilson, as well as the present study.

Further Studies Suggested

The study under investigation has suggested the possibility of further studies that could be carried forward and the use that could be made of the data revealed in this study. These are as indicated:

1. A similar study to the present one could be made by checking with adults only over a wide area. Neither the present study nor the Wilson study[1] has done this, the former being confined to grade children while the latter involved the study of children in New England and small groups of adults in limited areas.

2. Curriculum builders could profitably study the data revealed in this study as a basis for building a course of study in arithmetic.

3. A comparative study could be made for the purpose of testing the value of direct versus indirect teaching of the estimation of heights, distances, etc. A test could be given prior to, immediately following and some months after the teaching of such material to ascertain the value, retention, and carry over of each type of teaching procedure.

4. There is also the possibility of a study being made for the purpose of testing the value of teaching the tables of measures and denominate numbers from a drill standpoint as compared to the informal teaching of the same. The experimental group could be taught by means of problem units in which the material is drawn from the experiences of life with no attempt to memorize the tables of measures as such. The control group could be taught on a drill basis in which memory work is foremost. An objective test could be given at the close of the period of teaching to ascertain the merits of each type of teaching.

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APPENDIX A

List of Cities and Towns

A list of the towns and cities, by states, with the number of returns for each.

		City		Rural	
Alabama	50	Birmingham	9	Clanton	24
		Huntsville	17		
Arizona	63	Glendale	15		
		Phoenix	39		
		Tuscan	9		
Arkansas	77	Hope	4	Bonnerdale	18
		Little Rock	6	Gentry	22
		Texarkana	8	Hiwasse	10
				Horatio	9
California	1372	Banning	4	Angwin	34
		Brawley	12	Armona	26
		Burlingame	19	Arroyo Grande	23
		Chico	15	Camino-Placerville	21
		Corona	13	Cedar Springs	13
		Dinuba	16	Chowchilla	29
		El Centro	16	El Cajon	12
		Fresno	30	Escondido	15
		Fullerton	18	Gridley	4
		Hayward	13	Hemet	10
		Hollister	6	La Sierra	62
		Los Gatos	7	Loma Linda	164
		Modesto	33	Orland	7
		Mountain View	82	Rolinda	11
		Napa	16	Shafter	53
		National City	36	St. Helena	39
		Oakland	73	Winton	9
		Porterville	6		
		Palo Alto	6		
		Paso Robles	5		
		Red Bluff	5		
		Redwood City	48		
		Richmond	6		
		Riverside	29		
		Roseville	14		
		Sacramento	10		
		San Bernadino	40		
		San Diego	96		
		San Francisco	43		
		San Jose	10		
		Santa Ana	10		
		Santa Cruz	18		
		Santa Maria	11		

California cont'd.		Stockton	12		
		Ukiah	10		
		Vallejo	13		
		Viscalia	12		
		Watsonville	13		
		Yuba	4		
		Yucaipa	10		
Colorado	350	Boulder	44	Arvada	9
		Colorado Springs	12	Cedaredge	13
		Denver	89	Fort Lupton	10
		Fort Collins	6	Fruita	7
		Grand Junction	22	Golden	4
		Greeley	10	Hygiene	10
		La Junta	11	Jaroso	12
		Loveland	24	Palisade	15
		Monta Vista	8	Rulison	17
		Montrose	11		
		Pueblo	16		
Connecticut	33	Bridgeport	12		
		Hartford	12		
		New Haven	9		
District of Columbia	132	Takoma Park	132		
Florida	213	Fort Lauderdale	13	Maitland	20
		Jacksonville	10		
		Miami	36		
		Orlando	50		
		Pensacola	13		
		St. Petersburg	27		
		Tampa	32		
		West Palm Beach	12		
Georgia	49	Atlanta	26	Ellijay	4
		Columbus	9		
		Macon	10		
Idaho	73	Boise	25		
		Caldwell	19		
		Coeur d'Alene	22		
		Twin Falls	7		
Illinois	200	Aurora	6	Aledo	2
		Chicago	60	Broadview	53
		Duquoin	6	Humbolt Park	14
		Galesburg	6	Sheridan	10
		Hinsdale	16		
		Joliet	5		
		Peoria	14		
		Rockford	8		

		City		Rural	
Indiana	140	Bloomington	5	Cicero	17
		Elkhart	7		
		Evansville	9		
		Frankfort	7		
		Gary	10		
		Indianapolis	13		
		Kokomo	8		
		Marion	8		
		New Albany	4		
		Richmond	3		
		South Bend	40		
		Terre Haute	9		
Iowa	87	Anawa	3	Ludington	3
		Council Bluff	8	North Marion	11
		Davenport	6	Ruthven	7
		Des Moines	15	Waukon	5
		Dubuque	3		
		Fort Dodge	5		
		Nevada	11		
		Sioux City	12		
Kansas	44	Kansas City	5	Enterprise	13
		Topeka	4		
		Wichita	22		
Kentucky	30	Covington	20	Berea	3
		Louisville	7		
Louisiana	48	Baton Rouge	6		
		New Orleans	21		
		Shreveport	21		
Maine	23	Norredgewock	6	Woodstock	7
		Portland	10		
Maryland	12	Cumberland	12		
Massachusetts	180	Athol	6	South Lancaster	61
		Boston	17		
		Hudson	12		
		New Bedford	27		
		Springfield	9		
		Stoneham	13		
		Taunton	25		
		Worcester	10		
Michigan	587	Battle Creek	117	Bedford	11
		Benton Harbor	14	Berrien Springs	24
		Charlotte	13	Carlton Center	7
		Detroit	67	Clarenceville	24

		City		Rural	
Michigan cont'd.		Ferndale	13	Edenville	8
		Flint	30	Glenwood	10
		Grand Ledge	10	Gobles	8
		Grand Rapids	19	Holly	27
		Ionia	6	St. Louis	8
		Jackson	23	Urbandale	12
		Kalamazoo	27		
		Lansing	27		
		Muskegon	39		
		Owosso	12		
		Pontiac	20		
		St. Johns	11		
Minnesota	114	Anoka	5	Remer	20
		Austin	7	Welch	7
		Brainerd	6	Williams	5
		Hutchinson	14		
		International Falls	7		
		Minneapolis	28		
		St. Paul	15		
Mississippi	6	Vicksburg	6		
Missouri	98	Jefferson	6	Ava	8
		Joplin	4	Chloride	5
		St. Louis	38	Goldsberry	5
				McGee	6
				Rogersville	17
				Squires	9
Montana	43	Bozeman	11	Hamilton	9
		Great Falls	8		
		Livingston	7		
		Missoula	8		
Nebraska	101	Hastings	6	College View	59
		Lincoln	5	Shelton	9
		Omaha	16		
		Scottsbluff	6		
New Hampshire	10			West Lebanon	10
New Mexico	62	Albuquerque	8	Causey	9
		Clovis	8	Cleveland	9
		Las Cruces	4	Farmington	10
		Roswell	8	Peralta	6
New York	141	Binghamton	14	Burt	6
		Buffalo	10	Union Springs	14
		Jamestown	18		
		New York City	47		

		City		Rural	
New York Cont'd.		Rochester	16		
		Rome	6		
		Syracuse	10		
North Carolina	65	Charlotte	12	Fletcher	11
		Hendersonville	5		
		High Point	9		
		Morganton	10		
		Raleigh	7		
		Wilson	6		
		Winston-Salem	5		
North Dakota	11			Beach	5
				Sheyenne	6
Ohio	353	Canton	7	Pleasant Hill	295
		Cleveland	5		
		Lakewood	28		
		Toledo	18		
Oklahoma	150	Ardmore	5	Addington	9
		Lawton	3	Enid	10
		Muskogee	13	Ketchum	26
		Oklahoma City	40		
		Sapulpa	9		
		Tulsa	30		
		Wewoka	5		
Oregon	377	Ashland	4	Columbia City	15
		Bend	7	Gaston	43
		Eugene	19	Gladstone	16
		Grant Pass	36	Hopewell	9
		Hood River	11	Milton	22
		Kalmath Falls	11	Redmond	10
		La Grande	15	Royal	6
		Medford	28	Vale	9
		McMinnville	8		
		Newberg	14		
		Portland	68		
		Salem	18		
		The Dalles	8		
Pennsylvania	189	Allentown	19	Stairville	8
		Coudersport	10	Telford	12
		Harrisburg	7		
		Honesdale	7		
		Lebanon	4		
		Media	7		
		Norristown	12		
		Philadelphia	35		

		City		Rural	
Pennsylvania cont'd.		Pittsburgh	28		
		Reading	18		
		Scranton	6		
		Tamaqua	3		
		Wilkes-Barre	13		
Rhode Island	18	Providence	18		
South Carolina	4	Greenville	4		
South Dakota	31	Aberdeen	14	Redfield	6
		Sioux Falls	11		
Tennessee	150	Knoxville	11	Collegedale	29
		Lawrenceburg	12	Deer Lodge	13
		Memphis	32	Fountain Head	14
		Nashville	31	Leach	8
Texas	251	Amarillo	7	Beulah	4
		Corpus Christi	18	Douglass	8
		Dallas	21	Elgin	19
		El Paso	4	Jefferson	21
		Fort Worth	27	Keene	61
		Houston	18	Salmon	6
		Pampa	10		
		San Antonio	9		
		Weslaco	18		
Virginia	121	Bristol	10	Arlington	14
		Newport News	7	Kilmarnock	12
		Norfolk	4	Konnarock	34
		Richmond	16	New Market	7
		Roanoke	7	Stanley	10
Washington	280	Longview	9	Arlington	14
		Seattle	50	College Place	72
		Spokane	20	East Stanwood	14
		Vancouver	13	Yelm	6
		Walla Walla	24		
		Wenatchee	21		
		Yakima	37		
West Virginia	33	Huntington	10		
		Parkersburg	13		
		Princeton	10		
Wisconsin	177	Beloit	14	Bethel	25
		Clintonville	2	Clearwater Lake	11
		Eau Claire	7	Frederic	4
		Green Bay	8	Hylandale	9

		City		Rural	
Wisconsin cont'd.		Milwaukee	8	Lemon Valley	8
		Madison	9	Milton Junction	6
		Superior	11	Moon	11
				Oneida	10
				Raymond	8
				Sunny Dale	16
				Waupaca	10
Wyoming	25	Casper	12	Newcastle	10
				Ten Sleep	3

APPENDIX B

Right and Wrong Answers with

Most Common Answer for Sections I, II,& III

SECTION I

I - 1 Farmland

Right: acre, arpent, farm, piece, section.

Wrong: acre-lots, area, bushel, bushel or ground, contract, dollars, crop, dozen, farmer, feet, foot, land, lot, mile, mite, money, ounce, pan, paper, peck, plot, potatoes, pound, quart, real estate, share, sold, square acre, square feet, square mile, ton, weight, work, yard.

Most common answer: acre.

I - 2 Potatoes

Right: bag, bushel, hundredweight, half-bushel, hamper, peck, pound, sack.

Wrong: acre, bale, basket, barrel, box, bushel-barrel, bundles, cent, crop, chake, dozen, gallon, gallon-peck-pound, load, lug, measure, package, pick, pint, quart, sack-ton-pound, shats, side, tier, ton, 100.

Most common answer: pound.

Note: Where items in this study are the same as those in the Wilson study, the answers therein adopted have been accepted for the present study.

I - 3 Cotton lint

Right: pound

Wrong: acre, bag, bale, bale-pound, ball, basket, bat, belt, block, bottle, bt, bolt, bock, box, bunch, bulk, bundle, bushel, bund, carton, cargo, cord, cotton batton, cloth, crate, dozen, flax, feet, feet-yard, fiber, gallon, gin, heap, hundredweight, hundred, inch, keg, land, load, measure, ounce, ounce-pound, paper, package, peck, per bolt, peg, piece, poor cotton, pound-bale, pound-ton-bale, pound-ounce, price, quantity, quart, roll, row, sack, scale, skein, sheet, spool, string, square yard, sums, texsu, thick roll, ton, wagon, work, yard, yard-feet, 500 pound, 100 pound, 10 pound, 1 and $\frac{1}{2}$ pound.

Most common answer: pound

I - 4 Eggs

Right: case, crate, dozen, pound

Wrong: acre, box, bushel, carton, dozen-gross, number, ounce, peck, peck-dozen, sack, scale, ton, 36, 30, 12.

Most common answer: dozen

I - 5 Coal

Right: ton, pound

Wrong: acre, bag, bare, barrel, basket, box, bushel, bin, bunches, car, cart, cargo, carload, cicks, cord, coal, crate, cubic foot, dozen, dollars, fox, gunny sack, inch, large quantities, load, lug, pear, pen, pail-pound, pint, sack, sack-ton-pound, sack-ton, scales, shats, shovel, strand, ton-sack, truck, truckload, unit, weight, yard, $1.

Most common answer: ton

I - 6 Nails

Right: pound, keg

Wrong: any amount, bag, barrel, box, bond, bucket, bulk, bushel, bushel-pound, cage, cans, cast, carton, cent, cinc, cord, dozen, gross, hand, handed, hundredweight, inch, keg-bushel, length, letter, mailman, money worth, nails, number, ounce, pack, package, pad, pail, pakes, page, paper sack, peck, peck-bushel, peg, penny, pennyweight, piece, pint, poke, pound-barrel, pound-box, pound-crate, pound-ounce, pound-sack, pound-weight-keg, pound 25¢, quart, sack, size, steel, ton, truck, unit, weight, 100, 5¢ and 10¢ worth, 12 dozen, 1000, 2480, 5 and 10, 25 cents.

Most common answer: pound

I - 7 Wood

Right: bushel, cord, load, rack, rick, strand, tier, truck-load, wagon-load, pound

Wrong: acre, armful, any price, amount, basket, bale, bear, block, board, board feet, board foot, box, box-car, bulk, bundle, bushel-pound, cart, carload, cord-ton, cord-truck, crate, cubic, cubic feet, dollars, dozen, feet, foot, foot-yard, foot-cord-sack, freight, gross, hundredweight, inch, inches-feet, jag, keg, kind, land, length, links, logs, lumber, ounce, pack, peck, piece, pile, pint, planks, pole, posts, pound, quality, quart, rank, rod, sack, size, slab, square feet, stick, strip, ton, ton-cord, ton-load, ton-tier, truck, trees, tub, tub full, wagon, wheel-barrow, yard, yard-rod, 2 x 4, $$$$, $100, 1000, 1 quarter.

Most common answer: cord

Section II

II - 1 Inches in a foot

Right: 12

Wrong: 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 14, 16, 17, 20, 23, 24, 25, 26, 30, 32, 36, 38, 50, 60, 61, 144.

Most common answer: 12

II - 2 Seconds in a minute

Right: 60

Wrong: $\frac{1}{2}$, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 20, 23, 24, 25, 30, 34, 36, 40, 50, 56, 61, 62, 100, 120, 124, 125, 150, 160, 165, 200, 260, 520.

Most common answer: 60

II - 3 Cups of milk in a pint

Right: 2

Wrong: $\frac{1}{2}$, 1, $1\frac{1}{2}$, 1 3/4, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 20, 21, 27, 29, 30, 43, 50, 144, 1728, 1748, 6728.

Most common answer: 2

II - 4 Cubic inches in a cubic foot

Right: 1728

Wrong: 1, 1½, 2, 3, 4, 4½, 5, 5½, 6, 6½, 7, 7 3/10, 8, 9, 10, 11, 12, 12½, 13, 14, 15, 16, 16½, 17, 17-19, 17-22, 18, 18½, 18-22, 19, 20, 21, 22, 22½, 24, 25, 26, 27, 27½, 28, 30, 32, 32½, 33, 34, 36, 38, 40, 41, 42, 44, 46, 48, 50, 56, 58, 60, 72, 74, 75, 80, 81, 83, 84, 90, 96, 99, 100, 102, 104, 106, 108, 120, 124, 127, 128, 130, 137½, 140, 142, 144, 144 x 12, 148, 152, 160, 161, 162, 165, 166, 167, 168, 170, 171, 172, 175, 176, 180, 190, 192, 199, 225, 231, 237, 240, 244, 249, 250, 254, 255, 264, 288, 314, 316, 322, 324, 325, 327, 340, 360, 364, 374, 375, 428, 432, 496, 576, 588, 620, 640, 720, 864, 988, 1027, 1092, 1127, 1128, 1152, 1200, 1207, 1220, 1228, 1240, 1245, 1256, 1267, 1268, 1270, 1280, 1285, 1296, 1297, 1321, 1328, 1428, 1460, 1480, 1528, 1580, 1582, 1604, 1628, 1640, 1680, 1686, 1688, 1690, 1700, 1720, 1723, 1724, 1725, 1726, 1729, 1734, 1738, 1750, 1760, 1778, 1780, 1782, 1784, 1786, 1789, 1792, 1798, 1829, 1862, 1870, 1927, 2038, 2320, 2328, 2480, 2628, 2728, 2736, 2768, 2780, 2872, 2928, 3118, 3160, 3200, 3280, 3500, 3685, 4000, 5184, 5280, 5728, 5825, 7280, 7472, 7720, 8608, 16024, 20736.

Most common answer: 1728

II - 5 Acres in ¼ Section

Right: 160

Wrong: 1/3, ½, 1/25, 3/4, 2/3, ¼, 1, 1½, 2, 2¼, 2½, 3, 3½, 4, 4½, 5, 5¼, 6, 6¼, 6½, 7, 8, 9, 9 3/5, 10, 10½, 12, 12½, 13, 14, 15, 16, 16½, 17, 18, 19, 20, 21, 23, 24, 25, 25½, 26, 28, 27, 28, 29, 30, 30¼, 32, 33, 34, 35, 36, 40, 40-80-20, 41, 42, 45, 48, 48 1/3, 48 2/3, 50, 52, 56, 60, 64, 65, 70, 73, 75, 76, 80, 87, 89, 90, 96, 100, 103, 105, 110, 115, 116, 120, 121, 122, 124, 125, 128, 130, 136, 140, 144, 150, 152, 153, 155, 160, 164, 168, 170, 175, 180, 185, 199, 200, 203, 205, 210, 213, 215, 216, 220, 240, 250, 260, 264, 280, 300, 305, 308, 310, 320, 320½, 336, 340, 360, 365, 400, 437, 440, 450, 500, 550, 565, 560, 600, 610, 620, 624, 625, 640, 642, 644, 680, 880, 900, 1000, 1020, 1200, 1210, 1320, 1526, 2141, 5280, 100000, 200000, 1200 yd, ton, square mile, $17.28.

Most common answer: 160

II - 6 Pounds in bushel of wheat

Right: 60

Wrong: ½, 1, 1¼, 2, 2-3, 3, 4, 4½, 4-6, 5, 6, 7, 8, 9, 10, 10-11, 11, 12, 13, 14, 15, 16, 16¼, 16½, 17, 18, 19, 20, 21, 22, 23, 24, 25, 25-50, 26, 27, 28, 30, 30¼, 31, 32, 33, 34, 35, 36, 37¼, 38, 40, 42, 43, 44, 45, 48, 49, 50, 52, 53, 54, 55, 56, 56½, 57, 58, 59, 62, 62 1/5, 63, 64, 65, 66, 68, 70, 72, 73, 75, 76, 77, 78, 80, 80-100, 84, 86, 87, 87½, 88, 90, 95, 96, 98, 100, 100-150, 107, 108, 110, 112, 120, 125, 128, 130, 132, 140, 144, 145, 148, 150, 160, 178, 180, 196, 200, 240, 250, 256, 260, 280, 300, 320, 350, 375, 400, 412, 453, 500, 520, 560, 600, 660, 700, 1000, 2000, 3625, 5800, 30000000, 50 bale, 100 bushel, 1 peck, 4 pecks, peck-bushel

Most common answer: 60

II - 7 Pennyweight in an ounce

Right: 20

Wrong: 1/10, 1/8, 1/4, 1/5, 1/3, 1/2, 1, 1½, 1-2, 2, 3, 3½, 4, 5, 6, 6¼, 7, 7½, 8, 9, 10, 11, 12, 13, 14, 15, 16, 16½, 17, 18, 19, 21, 22, 24, 25, 26, 28, 29, 30, 31, 32, 36, 38, 40, 41, 44, 46, 48, 50, 60, 64, 65, 80, 100, 120, 144, 200, 220, 230, 320, 328, 360, 388, 425, 500, 720, 800, 900, 1600, 1728, 1770, 6000, ½#, foo, 150 pennies.

Most common answer: 16

II - 8 Dozen Eggs in a crate

Right: 30

Wrong: ½, 1, 2, 3, 4, 5, 6, 6½, 7, 8, 9, 10, 11, 12, 12 or 24, 12 or 24 or 30, 13, 14, 15, 15 or 30, 16, 16½, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28, 30 or 12, 32, 33, 34, 35, 36, 38, 39, 40, 42, 43, 44, 45, 46, 48, 50, 51, 52, 54, 55, 56, 60, 62, 64, 68, 70, 72, 75, 80, 84, 90, 92, 96, 100, 108, 110, 112, 120, 121, 122, 124, 125, 128, 130, 136, 144, 148, 150, 160, 170, 192, 200, 214, 216, 225, 228, 238, 240, 250, 275, 280, 288, 300, 320, 324, 350, 360, 363, 365, 366, 368, 370, 420, 432, 480, 600, 632, 760, 854, 1040, 1728, 600000, 2 pounds, 5 dozen, 1 gross, 6 feet, 18 eggs.

Most common answer: 12

II - 9 Rods in a mile

Right: 320

Wrong: 1, 2, 2½, 3, 4, 5, 5½, 6, 6¼, 6½, 7, 8, 9, 9½, 10, 10½, 11, 11½, 12, 12½, 13, 14, 14½, 15, 15½, 16, 16¼, 16½, 16 2/3, 17½, 18, 18½, 20, 21, 22, 23, 24, 25, 25½, 26, 27, 27½, 28, 29, 30, 30¼, 30½, 31, 31½, 32, 32½, 33, 33 1/3, 34, 34¼, 35, 36, 36¼, 36½, 37, 37½, 38, 40, 42, 43, 45, 46, 48, 50, 52, 52½, 54, 54½, 56, 57, 58, 60, 60¼, 60½, 62, 62½, 64, 64 2/3, 64 3/4, 65, 66, 66½, 68, 69, 70, 71, 72, 75, 76, 80, 88, 90, 91, 94, 98, 100, 102, 102½, 104, 105, 105 3/5, 106, 107, 109, 110, 112, 115, 117, 120, 122, 123, 124, 127, 128, 130, 132, 133, 134, 135, 136, 139, 140, 142, 143, 144, 150, 154, 156, 157, 158, 160, 161, 162, 163, 164, 165, 166, 168, 170, 172, 180, 183, 189, 192, 200, 199, 200-300, 203, 210, 216, 220, 222, 224, 225, 228, 230, 236, 240, 242, 248, 250, 254, 260, 262, 263, 264, 268, 270, 272, 275, 280, 285, 288, 296, 300, 301, 302, 306, 310, 315, 316, 319 2/3, 324, 325, 326, 327, 330, 330½, 331, 332, 336, 337, 339, 340, 341, 350, 352, 356, 360, 362, 362½, 364, 365, 366, 367, 369, 370, 374, 380, 381, 384, 385, 386, 394, 400, 405, 406, 420, 430, 450, 460, 462, 466, 480, 490, 500, 504, 506, 510, 520, 522, 523, 525, 527, 528, 529, 536, 538, 540, 542, 545, 548, 550, 552, 556, 560, 564, 580, 582, 600, 618, 620, 624, 630, 632, 640, 642, 650, 660, 665, 680, 685, 720, 723, 728, 760, 820, 850, 865, 920, 940, 950, 995, 1000, 1028, 1050, 1152, 1200, 1232, 1244, 1250, 1258, 1260, 1280, 1287, 1326, 1328, 1336, 1340, 1460, 1467, 1486, 1502, 1528, 1560, 1570, 1580, 1607, 1620, 1640, 1680, 1720, 1736, 1740, 1750, 1760, 1766, 1780, 1820, 1850, 2000, 2060, 2180, 2280, 2325, 2340, 2350, 2378, 2380, 2480, 2500, 2520, 2580, 2582, 2640, 2680, 2728, 2750, 2760, 2784, 2820, 2970, 3000, 3020, 3056, 3170, 3180, 3258, 3270, 3280, 3300, 3468, 3500, 3528, 3540, 3580, 3620, 3739, 4000, 4003, 4020, 4280, 4360, 5000, 5020, 5028, 5038, 5082, 5084, 5200, 5208, 5210, 5230, 5238, 5248, 5260, 5280, 5282, 5284, 5285, 5380, 5490, 5580, 5681, 5690¼, 5780, 5782, 5805, 5820, 5827, 5832, 5850, 5937, 6072, 6280, 6570, 6724, 7160, 7280, 8250, 8261, 8750, 9999, 10045, 10578, 10580, 18603, 57600, 87120, 100000.

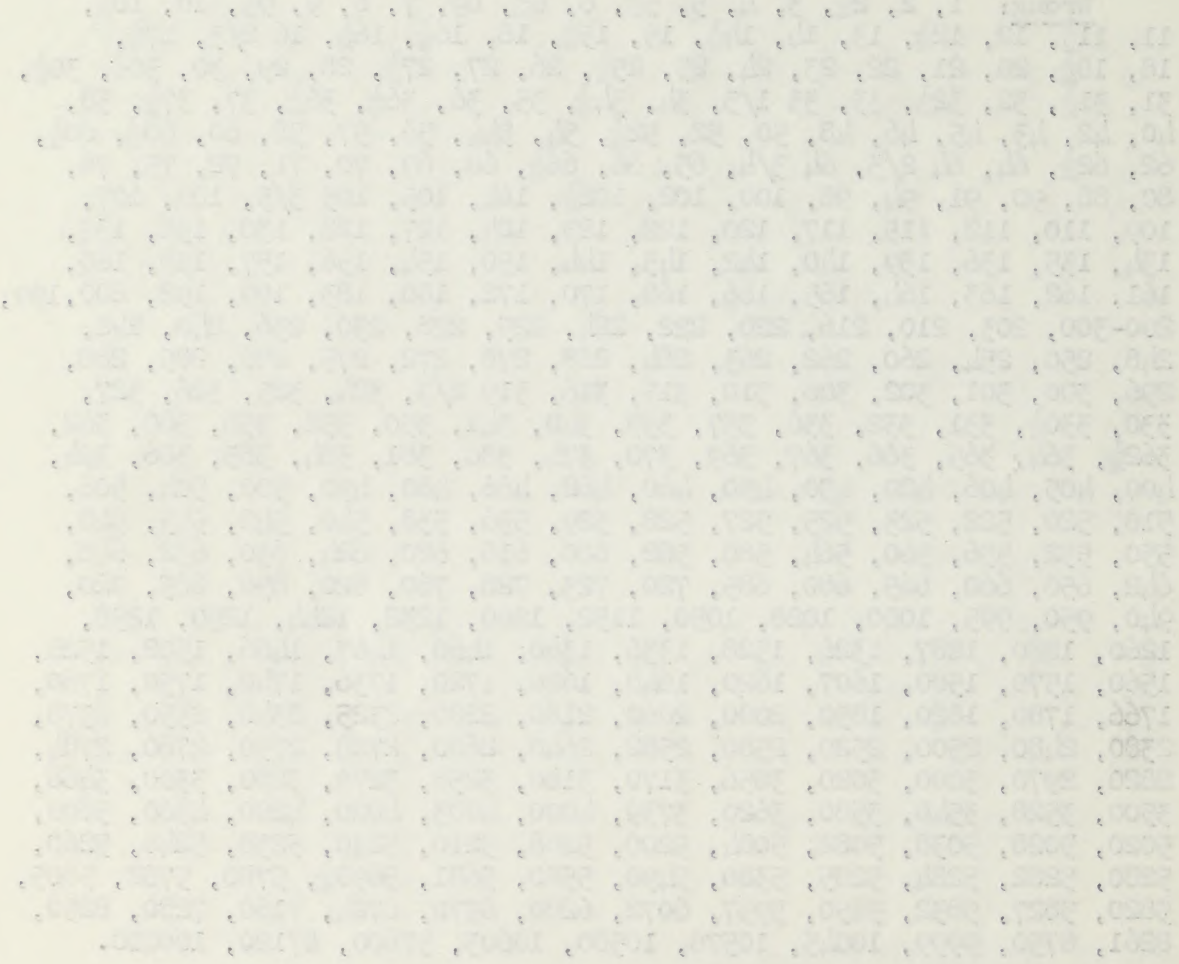
Most common answer: 320

II - 10 Pecks in a bushel

Right: 4

Wrong: 1, 2, 3, 5, 6, 6½, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 16½, 17, 18, 20, 21, 23, 24, 25, 26, 28, 32, 33, 34, 36, 40, 42, 45, 50, 60, 62, 64, 65, 75, 80, 89, 90, 99, 100, 104, 112, 116, 120, 141, 150, 200, 230, 300, 420, 500, 1000, 2000, 3650,

Most common answer: 4



II - 11 Average yield of cotton per acre

Fair estimate: *125 pounds to 500 pounds inclusive.

Wrong:

Pounds

1, 1½, 2, 3, 5, 6, 8, 9, 10, 12, 14, 15, 18, 20, 24, 25, 30, 32, 34, 35, 40, 45, 48, 50, 60, 65, 66, 70, 75, 80, 86, 87, 90, 100, 100-200, 120, 560, 600, 700, 780, 800, 900, 1000, 1000-3000, 1026, 1150, 1200, 1250, 1280, 1400, 2000, 3000, 4000, 5000, 10000, 13000, 16000, 34060, 60000, 10000000.

Bales

bale, 1/8, 1-2, 1½, 1½-2, 2, 2½, 3, 3½, 3-4, 3-5, 4, 4-5, 4-6, 5, 6, 7, 8, 10, 12, 13, 15, 18, 20, 24, 25, 30, 35, 36, 40, 50, 60, 65, 75, 80, 100, 111, 120, 140, 150, 200, 250, 265, 300, 400, 500, 600, 660, 900, 1000, 2000, 5000.

Bushels

bushel, ½, 1, 1-4, 1½, 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 15, 16, 18, 18.4, 19, 20, 21, 23, 25, 27, 28, 30, 35, 35-40, 36, 40, 42, 44, 45, 48, 50, 56, 60, 62, 65, 70, 75, 80, 82, 84, 90, 100, 120, 150, 160, 170, 200, 290, 300, 350, 400, 500, 550, 600, 650, 800, 1000, 1700, 1729, 2000, 3480, 5000.

Tons

ton, 1/3, 1/2, 1, 1-2, 1.2, 2, 2½, 3, 4, 4 or 5, 5, 5-6, 6, 7, 7½, 10, 12, 15, 18, 20, 25, 30, 40, 50, 100, 140, 160, 200, 300, 400, 500, 10000.

Miscellaneous

1/7, ¼, ½, 1, 1½, 2, 2½, 3, 4, 5, 4-6, 5, 6, 6½, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 20-25,21, 23, 24, 25, 27, 28, 30, 31, 32, 33, 34, 35, 36, 40, 42, 43, 44, 45, 48, 50, 51, 55, 56, 57, 58, 60, 62, 64, 66, 67, 70, 72, 75, 80, 85, 89, 95, 96, 98, 100, 102, 104, 110, 120, 132, 135, 140, 150, 200, 235, 240, 260, 300, 320, 330, 360, 400, 450, 472, 500, 600, 640, 740, 800, 835, 900, 936, 1000, 1200, 1232, 1400, 1500, 1900, 2000, 2500, 3000, 3265, 4200, 4840, 10000, 46000, 50000, foot, 3 feet, 4 feet, 12 feet, 18 feet, 50 feet, 150 feet, 5 sacks, 10 sack-1000 pound, 20 sacks, 25 sacks, 150 sacks, 500 sacks, ½ acre, 1 acre,

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* Everything within these limits was considered correct whether expressed in terms of pounds or bales.

2 acres, 5 acres, 8 acres, 10 acres, 12 acres, 60 acres, 524 acres, 1 mile, 50 miles, 10 peck, 2 peck, 50 peck, 10 yards, 30 yards, 50 yards, 54 yards, 50 gallon, 6000 bats, 1 ounce, 3¢, 40¢, 1 carload, 8 hundredweight, 14 packages, 50 bags, 3%, 10%, 50%, 70%, 75%, 90%, 100%, foo, wagon-full, good, pail, $1, $1.50, $1.95, $2, $2.10, $3, $5, $10, $20, $25, $42, $50, $51.95, $60, $100, $125, $150, $200, $400.

Most common answer: 1 bale

II - 12 Average yield of wheat per acre

Fair estimate: 10 bushel to 60 bushel

Wrong:

Bushels

bushel, 1, 1½, 2, 3, 4, 5, 6, 6-7, 7, 8, 9, 61, 62, 64, 65, 66, 68, 70, 72, 75, 80, 80-90, 80-100, 83, 85, 90, 95, 96, 98, 100, 100-200, 112, 120, 125, 144, 150, 160, 165, 200, 300, 350, 360, 400, 450, 500, 600, 720, 750, 800, 900, 1000, 1200, 1500, 1600, 1700, 1920, 2000, 3480.

Pounds

pounds, 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 16, 20, 24, 25, 30, 32, 36, 40, 48, 50, 60, 70, 75, 80-90, 85, 100, 110, 128, 150, 180, 200, 210, 265, 300, 350, 400, 432, 500, 506, 600, 640, 700, 1000, 1125, 1200, 1500, 2000, 2200, 2500, 3000, 4000, 5000, 5280, 20000.

Tons

ton, ½, 1, 1½, 2, 2½, 3, 4, 4½, 5, 6, 8 or 10, 10, 11, 12, 15, 20, 23, 25, 30, 40, 45, 48, 75, 90, 100, 102, 140, 150, 250, 500.

Sacks

2, 3, 4, 8, 10, 12, 15, 20, 23-32, 30, 40, 50, 55, 60, 68, 70, 100, 120, 150, 200, 1000, 4000.

Miscellaneous

1/12, ½, 3/4, 1, 2, 2½, 3, 4, 3-4, 5, 6, 7, 7½, 8, 8-10, 9, 9½, 10, 11, 12, 12-15, 13, 13¼, 14, 15, 16, 16¼, 17, 18, 20, 20-25, 21, 24, 25, 26, 27, 30, 30-40, 32, 35, 35-40, 36, 37, 38, 39, 40, 40-60, 43, 44, 45, 46, 48, 49, 50, 54, 55, 56, 60, 64, 65, 74, 75, 80, 82, 85, 86, 87, 90, 93, 98, 99, 100, 104, 105, 109, 110, 115, 120, 121, 125, 130, 135, 140, 145, 148, 150, 160, 180, 190, 193, 195, 200, 236, 241, 250, 300, 320, 350, 360, 400, 480, 500, 580, 675, 700, 800, 844, 1000, 1600, 1728, 2000, 2498, 2800, 3000, 3050, 3265, 4000, 4840, 5000, 6000, 6500, 12000, 15000, 50000, 1 peck, 4 peck, 6 peck, 12 peck, 70 peck, 50 yard, 60 yard,

60 gallon, 1 barrel, 10 bags, 4 feet, 10 feet, 12 feet, 150 feet, foot, number, 11d, 1 quart, good, truckload, 12½%, 40%, 50%, 75%, 80%, 90%, 100%, bale, 1 bale, 4 bales, 5 bales, 24 bales, 30 bales, 40 bales, 60 bales, 160 bales, 200 bales, 300 bales, half acre, acre, 1 acre, 2 acres, 4 acres, 5 acres, 6 acres, 10 acres, 12 acres, 60 acres, 100 acres, 500 acres, 1 mile, 25 mile, $1, $2.55, $3, $4, $4.50, $5, $10, $15, $16, $25, $42, $50, $60, $60.80, $73, $100, $200, $215.50, $280.

Most common answer: 60 bushel.

Section III

III - 1 Height of dining-room table

Fair estimate: *28 inches to 34 inches inclusive.

Wrong:

Inches

1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 15, 16, 16½, 17, 20, 21, 22, 23, 24, 25, 26, 27, 30-36, 35, 36, 36¼, 36½, 37, 38-40, 39, 40, 41, 42, 42½, 44, 45, 48, 50, 52, 54, 60, 63, 72, 100.

Feet

feet, 1, 1½, 2, 2 or 3, 2½-3, 2 feet 11 inches, 2 feet 3 inches, 2 feet 20 inches, 2 x 5, 3, 3 feet 2 inches, 3½, 3-4, 3 feet 8½ inches, 3 feet 9 inches, 3 x 6, 3 x 6 x 6, 3¼, 3½-4, 3 feet 6 inches, 4, 4½, 4 or 4½, 4 feet 7 inches, 4 feet 11 inches, 5, 5-8, 5 feet 3 inches, 6, 6-7, 7, 7½, 8, 9, 9 or 10, 9 x 12, 9 feet 4 inches, 10, 12, 12½, 12-6, 13, 20, 24, 30, 40, 50, 55, 64, 100, 200, 400.

Yards

yard, ½, 1, 1½, 2, 2½, 3, 4½, 12, 13.

Miscellaneous

1, 2, 2½, 2½ x 6 x 4, 2 3/4, 3, 3¼, 3½, 3½ x 4, 3 x 6, 4, 4-2, 4½, 4 or 5, 5, 5½, 5 3/4, 5 x 6, 6, 6 x 4, 6 x 5, 7, 8½, 9, 10, 11, 12, 12 x 4, 13, 14 x 15, 15, 16, 17, 18, 20, 22, 24, 26, 29, 30, 32, 33, 31, 35, 36, 38, 39, 40, 40-50, 42, 45, 48, 50, 56, 95, 108, 125, 211, 320, pound, 40 pounds, 50 pounds, 94 pounds, 100 pounds, 2000 pounds, 60 bales, ½ ton, 100R, yes, tall, 27 square feet, cubit, measure, all lengths, varies.

*Everything within these limits was considered correct whether expressed in terms of feet, inches or yards or a combination of any of them.

Most common answer: 3 feet.

III - 2 Height of living-room ceiling

Fair estimate: 7 feet to 10 feet inclusive

Wrong:

Feet

feet, 1, 2, 2½, 3, 3½, 4, 5, 5¼, 5½, 5 or 6, 6, 6½, 6 feet 9 inches, 6 feet, 9½ inches, 6 feet 11 inches, 10½, 10-11, 10 feet 3 inches, 10 feet 11 inches, 10-12, 10-14, 11, 11½, 11 feet 3 inches, 11 feet 4 inches, 11 feet 4½ inches, 11 feet 8 inches, 12, 12½, 12 feet 5 inches, 12 feet 17 inches, 13, 14, 15, 16, 17, 17-18, 18, 18-20, 19, 20, 21, 21 feet 11 inches, 22, 23, 24, 25, 25-30, 26, 28, 29, 30, 31, 36, 37, 40, 41, 44, 50, 54, 75, 81, 95, 100, 108, 180.

Inches

2, 3, 6¼, 8½, 9, 10, 12, 13, 16, 21, 24, 30, 32, 35, 36, 40, 45, 50, 56, 58, 60, 62, 65, 70, 72½, 80, 81, 156, 300, 400, 900.

Yards

yards, 1, 1½, 2, 3½, 4, 4½, 4-5, 5, 5½, 6, 7, 8, 8 yards 4 inches, 9, 10, 10½, 14, 20, 30.

Miscellaneous

2/3, 1, 1½, 2, 2½, 3, 3 or 2, 4, 4½, 5, 5½, 6, 6¼, 6½, 7, 7½, 7½-8, 8, 8½, 8-9, 8-10, 9, 9½, 9-10, 9-12, 9 x 10, 9 x 12, 10, 10½, 10 or 11, 10-12, 10 x 15, 11, 11-13, 12, 12-8, 12-14, 12 x 12, 12 x 15, 12 x 25, 12 x 34, 13, 13 x 12, 14, 15, 16, 18, 20, 20 x 10, 22, 24, 30, 30 x 27, 34, 35, 36, 37, 38, 40, 41, 42, 44, 45, 47, 48, 49, 51, 52, 60, 70, 72, 78, 81, 83, 84, 95 x 75, 100, 102, 108, 109, 167, 215, 250, 1000, 2000, ½ rod, 5½ weight, 3 x D, cubic feet, tall, no, length, all lengths, varies, 100 pounds, 150 pounds.

Most common answer: 8 feet.

III - 3 Distance between rails of railroad

Fair estimate: 4 feet to 5 feet inclusive

Wrong:

Feet

feet, ½, 3/4, 3/4-1, 1, 1¼, 1½, 1 foot 6 inches, 1 foot 7½ inches, 1 foot 10 inches, 1 foot 11 inches, 1-2, 2, 2 1/3, 2½, 2½ or 3, 2-3, 2¼, 2 feet 6 inches, 2 feet 10 inches, 2½-3, 3, 3¼, 3½, 3 4/5, 3 feet 4 inches, 3 feet 6 inches, 3 feet 9 inches, 3-4, 3½-4, 3 x 2, 4 x 5, 5½, 5 feet 2 inches, 5 feet 4 inches, 5 feet 5 inches, 5 feet 10 inches, 6, 6½, 6-7, 7, 7½, 7 feet 3 inches, 8, 8½, 8 feet 10 inches,

10, 11, 12, 12½, 14, 16, 18, 20, 22, 24, 25, 30, 33, 35, 40, 50, 60, 72, 75, 80, 90, 96, 100, 120, 150, 160, 165, 200, 400.

Inches

inches, 1/8, ½, 1, 1¼, 1½, 1 3/4, 2, 2½, 2 x 3, 3, 3½, 3 x 4, 4, 4½, 5, 6, 8, 8 or 10, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 24, 26, 27, 28, 30, 32, 33, 34, 36, 37, 39, 40, 41, 42, 43, 44, 45, 46, 64, 68, 72, 75, 78, 100, 413, 460.

Yards

yard, ½, 1, 1¼, 2, 2½, 3, 3½, 5, 6, 8, 10, 20, 24, 56, 100, 120.

Miscellaneous

1, 1½, 2, 2½, 2½ or 3, 2 3/4, 3, 3½, 3-4, 4, 4½, 4-6, 5, 5½, 6, 6½, 7, 8, 8 x 9, 9, 9½, 9-17, 10, 11, 12, 12½, 13, 14, 15, 16, 18, 20, 23½, 24, 25, 27, 29, 30, 32, 35, 36, 40, 43, 44, 45, 48, 52, 54½, 60, 71, 72, 74, 93, 100, 102, 401, 1003, 2000, yes, 1 block, 4 blocks, 1 rod, 1½ rods, 10 rods, ½ mile, 1 mile, 1½ miles, 3 miles, 5 miles, 20 miles, 30 miles, 66 miles, 1 minute, 1 rail.

Most common answer: 3 feet

III - 4 Glove size of average man

Fair estimate: size 6-10 inclusive.

Wrong:

Sizes

¼, 1, 2, 2½, 2 or 3, 3, 3½, 3 3/4, 4, 4 1/3, 4½, 4-7, 5, 5½, 5 3/4, 5-10, 6 x 5, 6 x 6, 6 x 9, 8 x 4, 10½, 11, 11½, 12, 12½, 12-14, 13, 14, 15, 16, 16½, 17, 18, 20, 22, 23, 24, 25, 26, 27, 30, 32, 32-30, 30 x 20, 35, 36, 38, 40, 45, 48, 50, 59, 62, 65, 70, 95, 116, 165, 170, 175, 810, 12345, 100000.

Feet

1/3, ½, 1, 1¼, 1½, 1 foot 6 inches, 2, 2 feet 4 inches, 2 feet 5 inches, 3, 3½, 4, 4½, 4 feet 7 inches, 5, 5½, 5 or 10, 5-6, 5 feet 3 inches, 5 feet 4 inches, 5 feet 5 inches, 5 feet 6 inches, 5 feet 7 inches, 5 feet 8 inches, 5 feet 9 inches, 5 feet 10 inches, 5 feet 11 inches, 5 feet 16 inches, 5 feet 48 inches, 5 x 3, 5 feet 8-9 inches, 6, 6½, 6-7, 6 feet 2 inches, 6 feet 3 inches, 6 feet 4 inches, 6 feet 5 inches, 6 feet 7 inches, 7, 7½, 7-8, 8, 8½, 9, 10, 11, 12, 15, 16, 17, 25, 60, 75 feet 7 inches.

Inches

inch, 1, 2, 2 x 3, 2 x 5, 3, 3¼, 3 3/4, 3-4, 3 x 4, 4, 4½, 4-5, 5, 5½, 5 x 4, 6, 6½, 6 3/4, 6 x 3, 6 x 4, 6 x 6, 6 or 8, 7, 7½, 7-8, 8, 8¼, 8½, 9, 9½, 9 or 11, 10, 11, 12, 12 x 16, 13, 14, 15, 16, 19, 20, 21, 22, 24, 27, 32, 36, 50, 52, 56, 59, 62, 70, 91, 110.

Miscellaneous

½ yard, 1 yard, 1½ yards, 2 yards, 3 yards, 20 miles, 200 miles, 90 pounds, average, no, pecks, large, my size, medium, half, big, women's size, middle, 160W.

Most common answer: size 8

III - 5 Width of regular full size bed

Fair estimate: 50 inches to 58 inches inclusive.

Wrong:

Inches

1½, 2, 4, 5½, 5 3/4, 6, 6 x 6, 7, 9, 9 x 9, 10, 12, 12½, 12 x 25, 14, 15, 17, 18, 20, 21½, 23, 24, 25, 26, 27, 28, 30, 30 x 20, 31, 32, 33, 34, 35, 36, 38½, 39, 40, 42, 43, 44, 45, 46, 48, 49, 59, 60, 61, 63, 64, 65, 66, 68, 70, 72, 74, 75, 77, 78, 81, 89, 90, 92, 100, 105, 118, 188, 201,

Feet

feet, foot, 1, 1½, 2, 2½, 2½ or 5, 3, 3½, 3½-4, 3 3/4, 3-4, 3 x 5, 3 x 6, 3 feet 3 inches, 3 feet 6 inches, 3 feet 8 inches, 3 feet 9 inches, 4, 4 or 4½, 4-6½, 4-9, 4-3½, 4 or 5, 4 x 6, 5, 5½, 5½, 5 3/4, 5-6, 5-7, 5½-6, 5 x 3½, 5 x 6, 5 x 7, 5 feet 2 inches, 5 feet 3 inches, 5 feet 4 inches, 6, 6½, 6½, 6-8, 6-4, 6 x 3, 6 x 3½, 6 x 4, 6 x 4½, 6 x 4, 6 x 8, 6 x 12, 6½ x 4½, 6 feet 4 inches, 6 feet 5 inches, 6 feet 6 inches, 6 feet 7 inches, 6 feet 10 inches, 6.5, 7, 7½, 7-9, 7 feet 4 inches, 7 x 3, 7 x 4, 7 x 4½, 7 x 6, 7 x 9, 7 x 15, 8, 8½, 8 feet 5 inches, 8 x 3, 8 x 5, 8 x 6, 8 x 12, 9, 9 x 4, 9 x 6, 10, 10-7, 10 x 6, 11, 12, 12 x 5, 12 x 6, 13, 14, 15, 18, 20, 21, 22, 24, 29, 30, 30 feet 20 inches, 34, 40, 48, 50, 52 x 98, 60, 62, 70, 80, 90, 100 feet 10 inches, 400.

Yards

yard, ½, 1, 1 3/4, 1 yard 8 inches, 1 yard 1 foot, 1-2, 2, 2-3, 2 yards 1 inch, 2¼, 2½, 3, 3½, 3 yard x 4 feet, 4, 4 yard 32 inches, 5, 10, 11, 20, 36½.

Miscellaneous

4/5, 1, 1½, 2, 2¼, 2½, 3, 3½, 3 x 3, 3 x 6, 3 x 26, 4, 4½, 4 3/4, 4 or 5, 4 x 6, 4 x 8, 5, 5½, 5 x 4, 5 x 7, 5 x 8, 5 x 10, 5½ x 4½, 6, 6½, 6-4, 6-12, 6 x 2, 6 x 4, 6 x 7, 6 x 8, 6 x 9, 6 x 10, 6 x 12, 6½ x 4½, 6 x 5, 7, 7½, 7 x 3½, 7 x 4, 7 x 4½, 7 x 5, 7 x 10, 8, 8¼, 8½, 8 x 4, 8 x 5, 8 x 6, 8 x 11, 9, 9½, 9 x 4, 9 x 12, 10, 10¼, 10½, 10 x 12, 12, 12-18, 12 x 15, 12 x 18, 12 x 24, 13 2/3, 13 x 5, 15, 18, 19, 20, 21 x 10, 24, 24½, 24 x 32, 25, 25 x 15, 26 x 20, 29, 30, 30 x 40, 32, 34, 35 or 40, 36, 36¼, 36 x 24, 38, 39, 44, 45, 46, 48, 50, 54, 55, 57, 60, 63, 65, 66, 70, 72, 72 x 12, 74, 75, 79 x 80, 81, 83-96, 95, 100, 105, 117, 120, 160, 200, 315, 2000, double, yes, ounces, 2 single, room for two, a bed, man's size, ½ pound, 6 x 5 pounds, 10 pounds, 12 pounds, 15 or 20 pounds, 24 pounds, 50 pounds, 60 pounds, 94 pounds, 100 pounds, 145 pounds, 150 pounds, 165 pounds, 342 pounds, 400 pounds, 600 pounds, 6 x 4 x 2 cubic feet, 4¼'s.

Most common answer: 4 feet

APPENDIX C

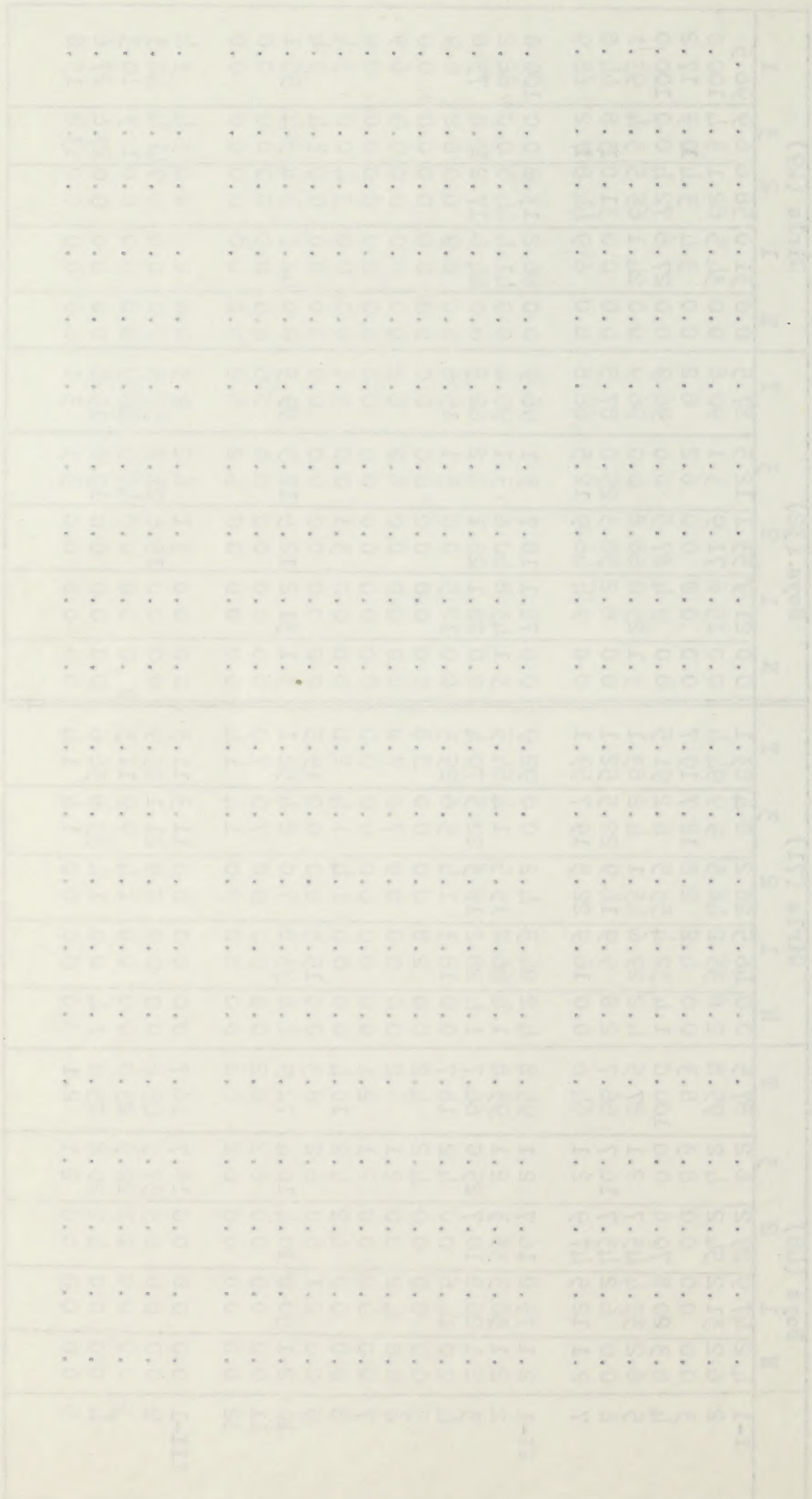
Raw Score Material

on

Five Selected States

Percentage of Correct Responses for Massachusetts Distributed on the Basis of N, 1, 2, 3.

	City (119)										Rural (61)									
	Boys (48)					Girls (71)					Boys (32)					Girls (29)				
	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T
I-1	4.2	47.9	29.2	6.2	87.5	0.0	46.5	28.2	8.4	83.1	0.0	21.9	53.1	12.5	87.5	0.0	31.0	58.6	6.9	96.5
2	6.2	31.2	54.2	4.2	95.8	2.8	35.2	46.5	9.9	94.4	0.0	15.6	71.9	3.1	90.6	0.0	34.5	62.1	3.4	100.0
3	0.0	0.0	0.0	8.3	8.3	0.0	4.2	2.8	12.7	19.7	0.0	0.0	0.0	6.2	6.2	0.0	3.4	3.4	10.3	17.2
4	8.3	20.8	70.8	0.0	100.0	1.4	32.4	53.5	4.2	91.5	0.0	9.4	87.5	0.0	96.9	0.0	27.6	72.4	0.0	100.0
5	6.2	35.4	43.7	2.1	87.5	4.2	29.6	45.1	4.2	83.1	3.1	25.0	68.8	0.0	96.9	0.0	24.1	65.5	3.4	93.1
6	0.0	6.2	43.7	16.7	66.7	2.8	9.9	16.9	22.5	52.1	0.0	6.2	56.3	25.0	87.5	0.0	0.0	31.0	13.8	44.8
7	2.1	12.5	47.9	2.1	64.6	0.0	16.9	22.5	19.7	59.1	0.0	9.4	46.9	12.5	68.8	0.0	6.9	44.8	17.2	68.9
II-1	2.1	75.0	16.7	2.1	95.8	4.2	84.5	4.2	0.0	92.9	0.0	78.1	18.7	3.1	96.9	0.0	86.2	13.8	0.0	100.0
2	2.1	58.3	33.3	2.1	95.8	1.4	66.2	15.5	1.4	84.5	3.1	43.8	40.6	3.1	90.6	0.0	41.4	44.8	0.0	86.2
3	2.1	20.8	18.7	25.0	66.7	1.4	28.2	18.3	22.5	70.4	0.0	28.1	28.1	6.2	62.5	0.0	44.8	17.2	13.8	75.8
4	0.0	14.6	0.0	4.2	18.7	0.0	18.3	1.4	5.6	25.3	0.0	12.5	0.0	3.1	15.6	0.0	6.9	0.0	0.0	6.9
5	0.0	0.0	0.0	4.2	4.2	0.0	2.8	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	4.2	0.0	2.1	6.2	0.0	0.0	0.0	7.0	7.0	0.0	0.0	0.0	6.2	6.2	0.0	0.0	0.0	6.9	6.9
7	0.0	0.0	0.0	2.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	6.2	4.2	10.4	0.0	0.0	1.4	1.4	2.8	0.0	0.0	3.1	0.0	3.1	0.0	0.0	3.4	0.0	3.4
9	0.0	2.1	0.0	6.2	8.3	0.0	15.5	0.0	0.0	15.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	3.4
10	2.1	50.0	10.4	10.4	72.9	2.8	33.8	7.0	8.4	52.1	3.1	31.2	12.5	12.5	59.3	0.0	42.3	3.4	3.4	55.1
11	0.0	0.0	0.0	6.2	6.2	0.0	0.0	0.0	7.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	6.2	6.2	0.0	0.0	0.0	1.4	1.4	0.0	0.0	0.0	6.2	6.2	0.0	0.0	0.0	0.0	0.0
III-1	0.0	0.0	0.0	16.7	16.7	0.0	0.0	0.0	11.3	11.3	0.0	0.0	3.1	6.2	9.3	0.0	0.0	0.0	3.4	3.4
2	0.0	0.0	8.3	37.5	45.8	0.0	0.0	2.8	21.1	23.9	0.0	0.0	15.6	21.9	37.5	0.0	0.0	6.9	41.4	48.3
3	0.0	0.0	2.1	22.9	25.0	0.0	0.0	1.4	9.9	11.3	0 .0	0.0	0.0	46.9	46.9	0.0	0.0	0.0	10.3	10.3
4	0.0	0.0	4.2	20.8	25.0	1.4	0.0	1.4	33.8	36.6	0.0	0.0	0.0	15.6	15.6	0.0	0.0	0.0	27.6	27.6
5	0.0	0.0	0.0	2.1	2.1	0.0	0.0	0.0	1.4	1.4	0.0	0.0	0.0	3.1	3.1	0.0	0.0	0.0	13.8	13.8

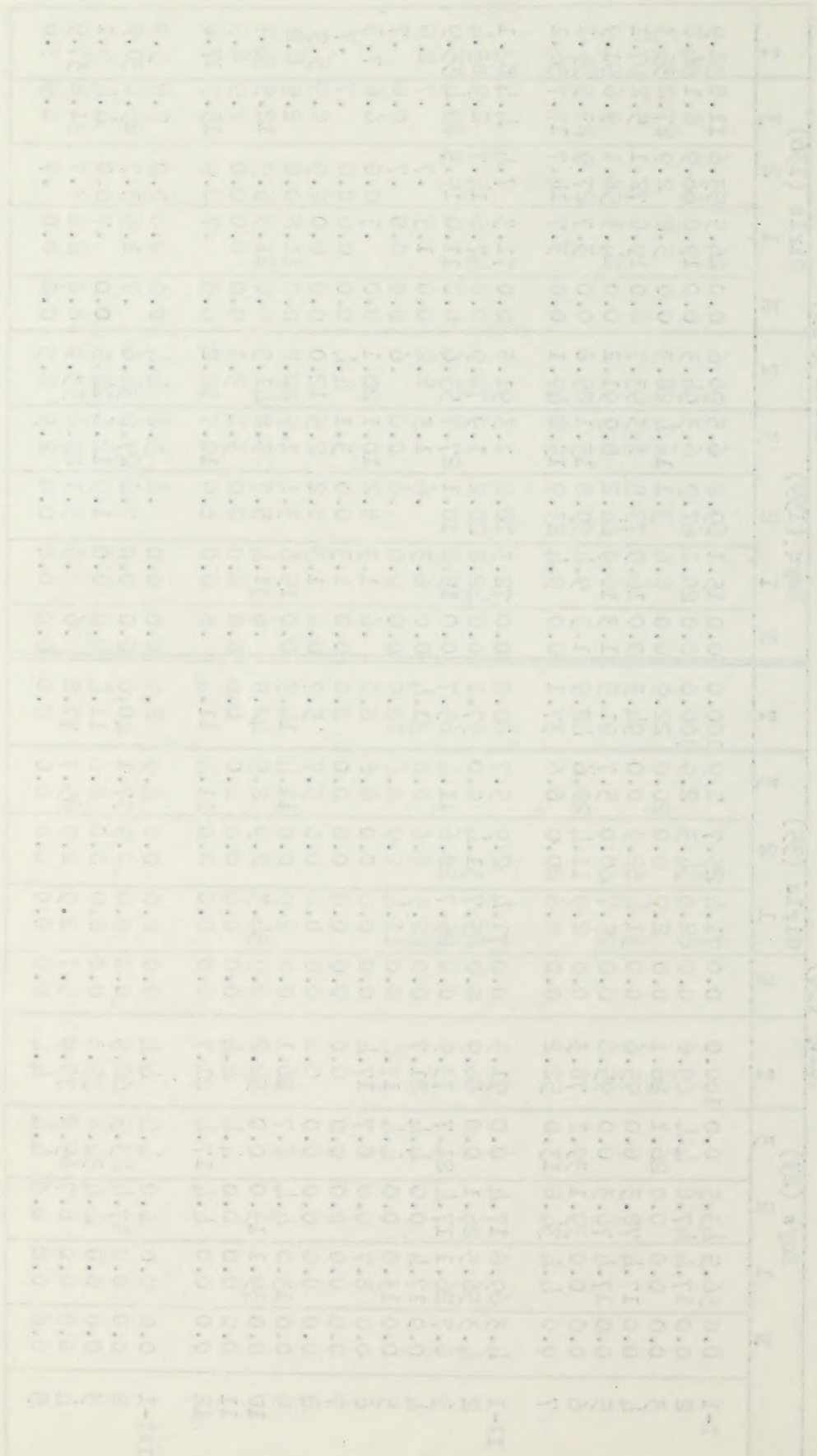


Percentage of correct responses for Minnesota Distributed on the basis of N, 1, 2, 3.

	City (82)										Rural (32)									
	Boys (36)					Girls (46)					Boys (17)					Girls (15)				
	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T
I-1	0.0	38.9	52.8	2.8	94.4	0.0	47.8	36.9	6.5	91.2	0.0	29.4	52.9	5.9	88.2	0.0	26.7	53.3	13.3	93.3
2	0.0	16.7	72.2	2.8	91.7	0.0	39.1	52.2	4.3	95.6	0.0	35.3	64.7	0.0	100.0	0.0	26.7	66.7	6.7	100.0
3	0.0	5.6	8.3	16.7	30.6	0.0	8.7	2.2	30.5	41.4	0.0	0.0	0.0	35.3	35.3	0.0	20.0	6.7	40.0	66.7
4	0.0	22.2	75.0	0.0	97.2	0.0	47.8	45.6	4.3	97.7	0.0	23.5	70.6	0.0	94.1	0.0	46.7	46.7	6.7	100.0
5	0.0	47.2	47.2	0.0	94.4	0.0	34.8	45.6	15.2	95.7	0.0	52.9	29.4	5.9	88.2	0.0	20.0	46.6	6.7	73.4
6	0.0	16.7	52.8	11.1	80.6	0.0	2.2	30.5	30.5	65.2	5.9	17.6	70.6	5.9	100.0	6.7	20.0	53.3	6.7	86.7
7	0.0	5.6	63.9	8.3	77.8	0.0	10.9	34.8	21.7	67.4	0.0	11.8	70.6	5.9	88.2	0.0	20.0	33.3	13.3	66.7
II-1	2.8	75.0	19.4	0.0	97.2	2.2	84.6	8.7	2.2	97.7	0.0	70.6	23.5	0.0	94.1	13.3	66.7	13.3	0.0	93.3
2	0.0	58.3	38.9	0.0	97.2	2.2	67.3	26.1	0.0	95.6	0.0	64.7	35.3	0.0	100.0	13.3	66.7	6.7	0.0	86.7
3	0.0	33.3	16.7	25.0	75.0	4.3	26.1	30.4	26.1	86.9	0.0	29.4	17.7	35.3	82.4	6.7	20.0	20.0	26.7	73.4
4	0.0	8.3	2.8	5.6	16.7	0.0	17.4	0.0	0.0	17.4	0.0	17.7	0.0	0.0	17.7	0.0	13.3	0.0	0.0	13.3
5	0.0	5.6	5.6	0.0	11.1	0.0	2.2	0.0	4.3	6.5	0.0	23.5	5.9	5.9	35.3	0.0	0.0	6.7	0.0	6.7
6	0.0	0.0	2.8	11.1	13.9	0.0	6.5	0.0	8.7	15.2	0.0	17.7	5.9	17.7	41.2	0.0	6.7	0.0	6.7	13.3
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.7
8	0.0	0.0	2.8	5.6	8.4	0.0	0.0	2.2	2.2	4.3	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.7	13.3	26.7
9	0.0	16.7	2.8	5.6	25.0	0.0	19.6	4.3	4.3	28.2	0.0	11.8	0.0	5.9	17.7	0.0	6.7	6.7	6.7	20.0
10	0.0	50.0	27.8	5.6	83.3	2.2	58.7	8.7	6.5	85.2	0.0	52.9	17.7	11.8	82.4	0.0	60.0	6.7	6.7	73.4
11	0.0	0.0	0.0	5.6	5.6	0.0	0.0	0.0	2.2	2.2	0.0	0.0	0.0	5.9	5.9	0.0	0.0	0.0	0.0	6.7
12	0.0	0.0	2.8	22.2	25.0	0.0	0.0	0.0	23.9	23.9	0.0	0.0	0.0	17.7	17.7	0.0	0.0	0.0	20.0	20.0
III-1	0.0	0.0	0.0	13.9	13.9	0.0	0.0	0.0	4.3	4.3	0.0	0.0	0.0	5.9	5.9	0.0	0.0	0.0	6.7	6.7
2	0.0	0.0	22.2	36.1	58.3	0.0	0.0	10.9	34.8	45.7	0.0	5.9	0.0	35.3	41.2	0.0	0.0	6.7	33.3	40.0
3	2.8	0.0	2.8	27.8	33.3	0.0	0.0	2.2	19.6	21.7	0.0	5.9	0.0	41.2	47.1	0.0	0.0	0.0	20.0	20.0
4	0.0	0.0	8.3	30.6	38.9	2.2	2.2	6.5	28.3	39.2	0.0	0.0	0.0	29.4	29.4	0.0	0.0	0.0	13.3	13.3
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.7

Percentage of correct responses for Ohio Distributed on the basis of N, 1, 2, 3.

	City (58)										Rural (295)									
	Boys (23)					Girls (35)					Boys (159)					Girls (136)				
	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T
I-1	0.0	56.5	43.5	0.0	100.0	0.0	71.4	25.7	2.9	100.0	0.0	15.1	69.2	6.3	90.6	0.0	26.5	53.6	11.8	91.9
2	0.0	17.4	47.8	4.4	69.6	0.0	62.8	34.3	2.9	100.0	0.0	20.1	67.9	6.3	94.3	0.0	19.8	66.9	8.1	94.8
3	0.0	0.0	0.0	26.1	26.1	0.0	2.9	0.0	20.0	22.9	0.0	8.8	3.1	16.4	28.3	0.0	5.2	2.9	27.2	35.3
4	0.0	17.4	78.3	0.0	95.6	0.0	31.4	62.9	0.0	94.3	0.0	16.9	75.5	1.3	93.7	0.0	19.8	72.1	5.2	97.1
5	0.0	17.4	78.3	0.0	95.6	0.0	25.7	60.0	5.7	91.5	1.3	16.9	64.2	8.9	91.2	0.0	24.3	58.1	9.6	91.9
6	0.0	0.0	39.1	39.1	78.3	0.0	2.9	11.4	28.6	42.9	1.3	9.4	59.8	15.1	85.6	0.0	3.7	27.9	23.5	55.1
7	0.0	4.4	34.8	13.0	52.2	0.0	8.6	20.0	8.6	37.1	0.0	9.4	23.9	15.8	49.1	0.0	3.7	14.7	17.7	36.1
II-1	4.3	69.6	17.4	0.0	91.3	0.0	71.4	2.9	5.7	80.0	0.0	72.3	18.2	1.3	91.8	0.0	71.3	7.4	4.4	83.1
2	4.3	56.5	26.1	0.0	86.9	0.0	65.7	31.4	0.0	97.1	0.0	42.8	28.2	1.9	72.9	0.0	47.8	14.7	2.9	65.4
3	8.7	26.1	17.4	21.7	73.9	0.0	25.7	28.6	11.4	65.7	0.0	15.8	10.1	27.7	53.6	0.0	11.0	15.5	29.4	55.9
4	0.0	17.4	0.0	4.4	21.7	0.0	22.9	8.6	0.0	31.4	0.0	6.3	.6	1.3	8.2	0.0	1.5	.7	.7	2.9
5	0.0	13.0	0.0	4.4	17.4	0.0	11.4	2.9	8.6	22.9	0.0	0.0	.6	0.0	.6	0.0	0.0	.7	0.0	.7
6	0.0	8.7	0.0	8.7	17.4	0.0	0.0	0.0	8.6	8.6	.6	1.3	8.2	10.1	20.1	0.0	.7	0.0	6.6	7.3
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	3.1	4.4	0.0	0.0	0.0	.7	.7
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	5.7	0.0	1.3	8.2	2.5	12.0	0.0	0.0	2.9	2.9	5.9
9	0.0	13.0	4.4	8.7	26.1	0.0	2.9	0.0	11.4	14.3	0.0	15.8	3.1	1.9	20.8	0.0	11.8	0.0	2.9	8.8
10	0.0	39.1	13.0	0.0	52.2	2.9	34.3	2.9	2.9	42.9	.6	31.4	5.7	3.8	41.5	0.0	21.3	5.9	12.5	39.7
11	0.0	0.0	0.0	4.4	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	3.1	0.0	0.0	0.0	2.9	2.9
12	0.0	0.0	4.4	17.4	21.7	0.0	0.0	0.0	11.4	11.4	.6	0.0	6.9	10.7	18.2	0.0	.7	2.9	13.9	17.6
III-1	0.0	0.0	0.0	4.4	4.4	0.0	0.0	0.0	2.9	2.9	0.0	0.0	.6	3.8	4.4	0.0	0.0	0.0	5.9	5.9
2	0.0	0.0	17.4	43.5	60.9	0.0	0.0	2.9	37.1	40.0	0.0	0.0	7.6	27.0	34.6	.7	1.5	3.7	25.0	30.9
3	0.0	0.0	4.4	34.8	39.1	0.0	2.9	0.0	8.6	11.4	0.0	0.0	1.9	12.6	14.5	0.0	.7	0.0	4.4	5.1
4	0.0	0.0	8.7	65.2	73.9	5.7	2.9	2.9	65.7	77.2	.6	.6	3.1	29.6	33.9	0.0	2.2	3.7	31.6	37.5
5	0.0	0.0	0.0	4.4	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5	0.0	0.0	.7	2.9	3.6



Percentage of correct responses for Texas Distributed on the basis of N, 1, 2, 3.

	City (132)										Rural (119)									
	Boys (53)					Girls (79)					Boys (65)					Girls (54)				
	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T
I-1	0.0	45.3	45.3	0.0	90.6	1.3	31.7	48.1	3.8	84.8	1.5	18.5	69.3	6.1	95.4	0.0	42.6	42.6	5.6	90.8
2	0.0	24.5	60.4	9.4	94.3	1.3	22.8	54.3	16.5	94.9	1.5	16.9	75.4	1.5	95.4	3.7	35.2	55.5	5.6	100.0
3	1.9	1.9	1.9	9.4	15.1	0.0	6.3	3.8	21.5	31.6	0.0	6.1	21.6	12.3	40.0	0.0	0.0	1.8	18.5	20.3
4	0.0	22.6	66.0	7.5	96.1	1.3	22.8	55.7	13.9	93.7	0.0	35.4	61.5	1.5	98.4	1.8	29.7	68.5	0.0	100.0
5	0.0	35.6	41.5	5.7	83.0	0.0	22.8	30.4	25.3	78.5	0.0	23.1	41.5	18.5	83.2	3.7	29.6	27.8	27.8	88.9
6	0.0	22.6	37.7	20.8	81.1	1.3	7.6	24.0	37.9	70.8	1.5	10.8	63.1	7.8	83.2	3.7	11.1	29.6	31.5	75.9
7	1.9	9.4	41.5	15.1	67.9	1.3	16.5	31.7	17.7	67.1	0.0	13.8	53.8	0.0	67.6	5.6	12.9	48.1	12.9	79.6
II-1	0.0	56.6	30.2	5.7	92.5	3.8	83.5	2.5	1.3	91.1	0.0	78.5	16.9	1.5	96.9	1.8	83.3	12.9	0.0	98.1
2	1.9	58.5	22.6	1.9	84.9	1.3	69.6	11.4	2.5	84.8	1.5	58.5	32.3	3.1	95.4	1.8	75.9	16.7	1.8	96.3
3	3.8	26.4	24.5	11.3	66.0	1.3	25.3	18.9	17.7	63.2	3.1	35.4	16.9	13.8	69.2	0.0	46.3	9.2	9.2	64.8
4	0.0	20.7	0.0	0.0	20.8	1.3	10.1	2.5	2.5	16.5	1.5	10.8	3.1	1.5	16.9	0.0	7.4	0.0	1.8	9.2
5	0.0	7.5	7.5	0.0	15.1	0.0	2.5	0.0	2.5	5.1	0.0	3.1	3.1	4.6	10.8	0.0	1.8	0.0	0.0	1.8
6	0.0	3.8	9.4	11.3	24.5	2.5	6.3	0.0	7.6	16.5	0.0	4.6	1.5	9.2	15.4	0.0	3.7	0.0	11.1	14.8
7	0.0	1.9	0.0	1.9	3.8	0.0	2.5	0.0	1.3	3.8	0.0	0.0	0.0	3.1	3.1	0.0	1.8	0.0	0.0	1.8
8	1.9	1.9	1.9	0.0	5.7	0.0	0.0	0.0	1.3	1.3	0.0	0.0	9.2	0.0	9.2	0.0	3.7	0.0	0.0	3.7
9	0.0	15.1	3.8	1.9	20.8	1.3	7.6	0.0	2.5	11.4	3.1	10.8	1.5	4.6	20.0	5.6	12.9	0.0	3.7	22.2
10	0.0	39.6	13.2	7.5	60.3	0.0	44.3	5.1	5.1	54.5	3.1	44.6	15.4	3.1	66.2	0.0	38.9	7.4	12.9	59.2
11	0.0	0.0	5.7	16.9	22.6	0.0	0.0	1.3	12.6	13.9	0.0	1.5	15.4	7.8	24.6	0.0	0.0	1.8	12.9	14.8
12	0.0	0.0	7.5	9.4	16.9	0.0	0.0	2.5	7.6	10.1	0.0	0.0	3.1	7.8	10.8	0.0	0.0	0.0	12.9	12.9
III-1	0.0	0.0	0.0	3.8	3.8	0.0	0.0	0.0	5.1	5.1	0.0	0.0	0.0	7.8	7.8	0.0	0.0	0.0	7.4	7.4
2	0.0	0.0	15.1	28.3	43.4	1.3	0.0	2.5	22.8	26.6	1.5	1.5	10.8	21.5	35.3	0.0	5.6	7.4	18.5	31.5
3	0.0	0.0	7.5	15.1	22.6	0.0	0.0	2.5	6.3	8.8	0.0	0.0	1.5	10.8	12.3	0.0	0.0	1.8	12.9	14.8
4	3.8	0.0	3.8	16.9	24.5	1.3	0.0	1.3	37.9	40.5	0.0	0.0	4.6	20.0	24.6	0.0	0.0	0.0	16.7	16.7
5	0.0	0.0	5.7	5.7	11.4	0.0	0.0	0.0	1.3	1.3	0.0	0.0	1.5	3.1	4.6	0.0	0.0	0.0	5.6	5.6

Percentage of correct responses for Washington Distributed on the basis of N, 1, 2, 3.

	City (174)										Rural (106)									
	Boys (82)					Girls (92)					Boys (52)					Girls (54)				
	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T	N	1	2	3	T
I-1	1.2	21.9	60.9	10.9	95.1	0.0	38.0	43.5	8.7	90.2	0.0	21.1	67.3	3.8	92.3	1.8	35.2	53.7	1.8	92.6
2	0.0	18.3	70.7	8.5	97.6	0.0	17.4	57.6	19.6	94.6	1.9	3.8	84.6	3.8	94.2	1.8	9.3	70.4	9.3	90.7
3	0.0	6.1	15.9	15.9	37.8	0.0	1.1	5.4	20.6	27.1	0.0	5.8	13.5	21.1	40.4	0.0	0.0	1.8	50.0	51.8
4	0.0	20.7	74.4	2.4	97.6	1.1	26.1	67.4	3.2	97.8	1.9	11.5	78.8	0.0	92.3	0.0	9.3	79.6	3.7	92.6
5	1.2	14.6	65.8	7.3	89.0	2.2	30.4	34.8	14.1	81.3	1.9	21.1	55.8	13.5	92.3	0.0	25.9	50.0	12.9	88.9
6	1.2	9.7	53.7	26.8	91.5	1.0	13.0	27.2	35.9	77.2	5.8	5.8	57.7	17.3	86.5	0.0	7.4	24.1	44.4	75.9
7	1.2	8.5	76.8	7.3	93.9	0.0	9.8	63.0	11.9	84.8	1.9	5.8	80.8	0.0	88.5	0.0	24.1	46.3	18.5	88.9
II-1	0.0	73.2	23.2	0.0	96.3	0.0	70.7	15.2	2.2	88.0	5.8	65.4	23.1	1.9	96.2	0.0	88.9	9.3	0.0	98.1
2	0.0	63.4	26.8	2.4	92.6	0.0	58.7	22.8	4.4	85.9	3.8	50.0	32.7	5.8	92.3	0.0	74.1	20.4	0.0	94.4
3	0.0	28.1	21.9	23.2	73.2	2.2	21.7	30.4	20.7	75.0	3.8	28.9	21.1	11.5	65.4	0.0	42.6	18.5	12.9	74.1
4	1.2	13.4	0.0	1.2	15.8	0.0	7.6	1.1	3.3	11.9	0.0	13.5	0.0	0.0	13.5	0.0	3.7	0.0	1.8	5.6
5	0.0	0.0	1.2	4.9	6.1	0.0	0.0	0.0	1.1	1.1	0.0	1.9	0.0	1.9	3.8	0.0	1.8	0.0	0.0	1.8
6	0.0	0.0	0.0	6.1	6.1	0.0	0.0	1.1	3.3	4.4	0.0	5.8	5.8	7.7	19.2	0.0	1.8	0.0	3.7	5.6
7	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	1.1	4.4	0.0	0.0	0.0	1.9	1.9	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	1.2	1.2	2.4	0.0	0.0	1.1	2.2	3.3	0.0	0.0	3.8	1.9	5.8	0.0	0.0	3.7	5.6	9.3
9	0.0	6.1	1.2	1.2	8.5	0.0	5.4	1.1	3.3	9.8	0.0	15.4	1.9	0.0	17.3	0.0	14.8	0.0	0.0	14.8
10	3.7	14.6	3.7	10.9	32.9	0.0	19.6	0.0	13.0	32.6	1.9	46.1	3.8	0.0	51.9	0.0	35.2	3.7	7.4	46.3
11	0.0	1.2	0.0	3.7	4.9	0.0	0.0	0.0	1.1	1.1	0.0	1.9	0.0	7.7	9.6	0.0	0.0	0.0	1.8	1.8
12	0.0	2.4	4.9	17.1	24.4	0.0	0.0	1.1	16.3	17.4	0.0	0.0	9.6	5.8	15.4	0.0	0.0	1.8	1.8	3.7
III-1	0.0	0.0	1.2	3.7	4.9	1.1	0.0	0.0	11.9	13.0	0.0	0.0	0.0	9.6	9.6	0.0	1.8	1.8	5.6	9.3
2	1.2	1.2	8.5	53.7	64.6	0.0	0.0	6.5	39.1	45.7	1.9	0.0	26.9	28.9	57.7	0.0	0.0	3.7	29.6	33.3
3	0.0	0.0	2.4	20.7	23.1	0.0	0.0	0.0	13.0	13.0	0.0	0.0	9.6	23.1	32.7	0.0	0.0	0.0	3.7	3.7
4	0.0	0.0	6.1	34.1	40.2	1.1	0.0	3.3	39.1	43.5	0.0	1.9	15.4	17.3	34.6	0.0	0.0	5.6	27.8	33.3
5	0.0	0.0	3.7	9.7	13.4	0.0	0.0	1.1	5.4	6.5	1.9	0.0	1.9	5.8	9.6	0.0	0.0	0.0	1.8	1.8

APPENDIX D

Average Yields for Cotton and Wheat

taken from

Cotton Yearbook of the New York Cotton Exchange

and

Crops and Markets

published monthly by the

United States Department of Agriculture

COTTON - YIELD PER ACRE IN POUNDS

State	Average 1928-1937	Average 1933-1937	1937
Virginia	284	293	312
North Carolina	281	309	338
South Carolina	243	267	289
Georgia	212	239	270
Florida	144	157	162
Alabama	205	233	290
Tennessee	235	254	320
Mississippi	225	262	372
Louisiana	214	236	337
Arkansas	206	219	298
Missouri	313	334	346
Texas	147	151	197
Oklahoma	133	121	156
California	491	545	570
Arizona	371	417	501
New Mexico	406	459	490
All others	275	289	361
	190.3	206.6	214.1

WHEAT - YIELD PER ACRE IN BUSHELS

State	Average 1928-1937	1938	Indicated May 1, 1939
New York	20.0	25.0	23.0
New Jersey	21.8	22.0	22.0
Pennsylvania	18.8	21.0	20.5
Ohio	19.3	19.5	19.0
Indiana	16.9	16.0	16.5
Illinois	17.1	18.5	17.0
Michigan	19.9	21.5	22.0
Wisconsin	17.6	16.5	18.0
Minnesota	18.7	13.5	19.0
Iowa	18.3	16.5	20.0
Missouri	13.7	13.0	13.5
North Dakota	---	---	---
South Dakota	11.5	11.5	10.0
Nebraska	14.6	12.0	13.5
Kansas	12.5	10.5	11.0
Delaware	17.4	20.0	19.0
Maryland	18.8	20.0	19.5
Virginia	14.3	14.0	14.0
West Virginia	14.7	15.0	15.0
North Carolina	10.6	11.5	11.0
South Carolina	9.8	11.0	10.5
Georgia	8.8	10.0	9.0
Kentucky	13.6	15.0	13.0
Tennessee	10.9	11.0	10.5
Alabama	10.0	13.0	11.5
Arkansas	9.2	8.5	8.5
Oklahoma	11.7	11.0	11.0
Texas	10.2	9.0	10.5
Montana	12.8	23.5	16.0
Idaho	19.7	25.0	20.5
Wyoming	11.0	13.0	12.5
Colorado	11.4	14.5	14.0
New Mexico	9.4	10.0	13.0
Arizona	22.2	22.2	22.2
Utah	16.4	21.0	14.0
Nevada	25.5	27.0	27.0
Washington	23.5	27.0	23.0
Oregon	19.6	21.5	20.0
California	18.5	17.0	16.0
	14.5	13.8	14.0

APPENDIX E

Validation of the Questionnaire

Validation of the Questionnaire

Validity is a matter of objectives. It is fundamentally a curricular problem and can not be established by mere statistical treatment. The most helpful use of statistics may be, and in the present study is, in the treatment of the data gathered in pursuit of the study.

In the past certain objectives have been assumed for the teaching of measures and denominate numbers. A dozen or more studies cited in Chapter I, have definitely challenged the older objectives. This study is a curricular study, seeking to go further than other studies have gone and to secure a final answer to some of the curricular questions previously raised.

The questionnaire used is not a test. It is a device for gathering data on the simple and obvious in the field of measures and denominate numbers.

During the course of this study the question of validity naturally came up. In so far as the present study relates to child and adult usage, the only statistical items of value are frequency and relative frequency. Differences in frequency or in percentages therefore become important. These have been adequately cared for throughout the study. The customary statistical procedures for reliability have not been applied since the basis for the study is a questionnaire and not a test. Symonds recognizes that there is a difference.[1]

1. Symonds, Percival M., Measurement in Secondary Education, The Macmillan Company, New York City, 1928, page 361.

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1. Symonds, Percival M., Measurement in Secondary Education, The Macmillan Company, New York City, 1925, page 361.

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